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GROWER-PROCESSOR INTEGRATION

A study of vertical integration between growers and processors of tomatoes in California

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SUMMARY

California tomato processors and growers integrate certain of their production and marketing activities. On these matters, the firms do not make independent decisions but instead relinquish some of their autonomy to each other or to a joint decision-making unit. This bulletin presents the results of a study of vertical integration between growers and processors of California tomatoes. The publication explains the nature and extent of the integration found in this industry, discusses the benefits integration confers on both parties, and cautions that vertical integration is not a panacea for all agricultural problems.

The extent of integration depends upon an extremely complex combination of economic and noneconomic forces. Perhaps the most important force encouraging integration between California tomato canners and growers is their desire to reduce uncertainty. Integration gives the canner some control over his tomato supplies, regarding their quantity, quality, location, and timing of delivery to the processing plant. It gives the grower an assured market for his crop. To both parties it means the establishment of policies on prices and other matters.

The degree of integration (i.e., the number of grower decisions controlled) in this industry varies. For example, canners' fieldmen give much more advice to new and inexperienced growers than to established ones;

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and processors are likely to exercise more rigid control over growers who are financially indebted to them. In ascertaining the degree of integration, one must not confuse all services provided by canners as forms of integration. Some of these services are simply nonprice payments to growers.

Some economic forces are operating to encourage disintegration. For example, California tomato growers are now specialists in their business, and canners do not need to control as many of their production practices as they once did. Also, processors no longer require growers to buy seeds or plants from them in order to control product quality; virtually all seeds and plants are now grown by specialized firms. Canners do less financing of growers today than they did in the past; banks satisfy most credit needs now that growers have increased their financial strength. Processors have less incentive than ever to integrate completely to the farm level, i.e., to grow their own crops, because growers in this industry generally produce tomatoes that meet canners' needs.

In spite of its many advantages for growers and canners, vertical integration is not a solution for all agricultural problems. It may facilitate adjustments of supply; but the extent of horizontal integration may be more important in affecting production stability. Similarly, it is the relative market power of the participants, and not the mere existence of vertical integration between them, that is the crucial determinant of farmer and processor incomes.

I. Nature and Scope of the Study

WHAT IS GROWER-PROCESSOR INTEGRATION?

Grower-processor integration is the linking—by contract or otherwise—of certain activities and decisions of growers and processors so that either or both relinquish some of their rights in producing and marketing their products. For example, one party may agree to permit another to make a decision which previously he had made independently, or both may agree to make decisions jointly which previously one or both had made independently. In either case, the effect is the same: certain production and marketing activities, on which individual firms would otherwise make independent managerial decisions, become integrated under a single or joint decision-making unit. Thus, each firm does not strive directly for its own profit objective. Its actions are constrained by a new profit goal which must compromise the income objectives of the participants since no set of actions is customarily found which simultaneously maximizes the expected profit position of each.

This may be considered as one form of vertical integration. The term vertical integration is generally used to indicate the coordination of decision-making processes of two or more stages of production. There are many gradations in the degree of such coordination. The limiting form of integration, for example, is found where successive stages of production are brought under unified management through *ownership*, either through merger of previously independent firms or through the vertical expansion of one firm's activities by internal growth. Grower-processor integration usually is a less complete form of integration than that created by ownership—it covers fewer activities and decisions, is more readily altered or terminated, and permits retention of ownership identity.[1]

PURPOSE OF STUDY

Although grower-processor integration in various forms has been common to California agriculture for decades, there are important gaps in our knowledge of its scope and economic significance. Its wide and apparently growing use in many agricultural industries has stimulated questions concerning its effects. To understand its advantages and disadvantages and to see how these are shared between the integrated parties requires more thorough knowledge than is presently available. As a step toward obtaining more complete information on these

[1] Some economists may disagree with the use of the term vertical integration to describe this relationship. For example, Oxenfeldt defines control of successive stages of production as "vertical extension" and reserves the term vertical integration for the case where such control is accomplished through ownership. Oxenfeldt, Alfred R., *Industrial Pricing and Market Practices* (New York: Prentice-Hall, 1951), p. 207. In research, however, economists often find this definition too narrow to be operational. For example, J. G. McLean and R. W. Haigh employ a definition similar to that used in this paper. *The Growth of Integrated Oil Companies* (Boston: Harvard University Press, 1954), p. 8.

matters, it was decided to make an intensive study of a California agricultural industry in which such integration exists.[2]

We believe the northern California tomato canning industry presents a significant instance of grower-processor integration. It ranks among the most important of the California processed fruit and vegetable industries. In 1956, California growers harvested 151,500 acres of canning tomatoes; they produced 2,772,400 tons of tomatoes, which they sold to processors for $62,933,480.

In addition to its economic importance, this industry was selected for study because of two other characteristics. First and most important, it is an industry in which grower-processor integration exists. Growers do not make completely independent decisions in producing and marketing their products nor do they sell in an "open market." Instead, some of their activities are coordinated or integrated with those of particular buyers. Second, integration in this industry is not complicated by state and federal marketing programs such as are common to many California agricultural industries.

The exploratory hypothesis of this study is that there are certain indentifiable economic reasons for farmers and processors to integrate their activities in certain respects. Economic theory suggests some crucial factors involved in selling and buying agricultural products which may encourage integration, and others which may influence the distribution of income between the integrated parties. But understanding the specific causes and effects of integration in a particular industry requires empirical study of its unique characteristics. This process requires the researcher to move systematically: he must test hypotheses suggested by economic theory and modified by reality as he becomes familiar with the industry's structural and other economic and institutional components. Specifically, this study will try to answer the following questions:

What is the economic structure of the California tomato industry?

What is the extent and form of the integration found in this industry, and what production and marketing problems encourage farmers and processors to become integrated?

How does the pricing process work in this industry?

What are the implications of the integration existing in this industry?

THEORETICAL BASES OF VERTICAL INTEGRATION

The conditions encouraging integration of farm and processing activities may best be understood by first examining circumstances in which there is little or no need for it. Consider the selling and procurement policies of a firm which achieves optimum size when performing a single function and which buys and

[2] Three studies have been made at the University of California which touch on vertical integration in California agriculture. Two of these deal with the integration between broiler producers and credit institutions, feed suppliers, hatcheries, and others as a result of various financing arrangements. See Abbott, John C., *Fryer Marketing in the East San Francisco Bay Area, California* (Berkeley: University of California, Division of Agricultural Sciences, Agricultural Experiment Station, March, 1953), 86p. (Giannini Foundation Mimeographed Report No. 146.) Processed. Also, Naden, K. D., and G. A. Jackson, Jr., *Financing Western Broiler Production* (Berkeley: 1956), 32p. (California Agricultural Experiment Station Bul. 753.) Another study deals with the way in which marketing contracts integrate farmers with their cooperatives. Of course, this is a more complete form of integration than we are concerned with in the present study because it is based on ownership. But in many respects it is similar in effect to that existing between farmers and noncooperative processors. See Mueller, W. F., and J. M. Tinley, *Membership Marketing Contracts of Agricultural Cooperatives in California* (Berkeley: 1958), 64p. (California Agricultural Experiment Station Bul. 760.)

sells in a perfectly competitive system of markets. A processing firm operating under such conditions will not decrease its costs by performing additional functions of production; at any time it can buy the kind and amount of a product it wants at prevailing market prices.[3] It would have no incentive to become vertically integrated with its sources of supply either through ownership or otherwise. In fact, it would be expected to avoid doing so because this would increase its costs and decrease its operating flexibility by obligating it to obtain its requirements from a particular source. For the same reasons, farm firms of this type operating in such markets would have no need to integrate forward into processing.

In such a theoretical world, it is price that coordinates—or integrates—the activities of buyers and sellers. And price performs this coordinating job perfectly: with prices as their guide, farmers produce the right products at the right time in response to consumers' demands as reflected perfectly through all stages of the marketing system.

But the real world departs markedly from this theoretical model. The cost conditions associated with some stage of production or marketing may be related to the decisions made in connection with another stage. And imperfect markets are the rule rather than the exception: market knowledge is usually poor, not perfect; and buyers are often few, not many. The existence of such technological and market conditions may encourage firms to become vertically integrated to some degree.

Technological conditions

Two technological conditions may encourage integration. First, the physical input-output relationships of certain stages of production and marketing may be interrelated.[4] In this event, the technical possibilities existing at any particular stage are affected by activities and operations carried on in the performance of another stage. For example, costs at one stage may depend on whether the preceding stage took place immediately before or in the immediate vicinity. The classic case of this is found in the steel industry where, if such interrelationships are ignored, molten iron may be allowed to cool, moved to another plant, and then reheated prior to further processing. The economic importance of this is that the costs associated with certain functions are interdependent as a result of these physical input-output relationships.

The second technological condition refers to the costs associated with different levels of production. When an industry is new (small relative to its optimum size), individual firms within it are sometimes forced to integrate a related service function with their main line of business even though the particular function is operated at far lower than optimum levels. The average costs associated with such services often decline steadily for a considerable range in the scale of operation. Thus, when the industry has expanded enough to support a specialized firm engaged in providing these services at optimum levels, the firms originally carrying on these functions are able to disintegrate them from their regular operations. For this reason, the size and state of development of an industry may strongly influence the extent of vertical integration of its component stages.[5]

Market conditions

Market uncertainty of several types

[3] Adelman, M. A., "Concept and Statistical Measurement of Vertical Integration," *Business Concentration and Price Policy* (New York: National Bureau of Economic Research, 1955), p. 319. (Special Conference Series, No. 5.)

[4] Stigler, George J., "The Division of Labor is Limited by the Extent of the Market," *Journal of Political Economy*, vol. LIX, no. 3, June, 1951, p. 187. Florence, P. Sargant, *The Logic of British and American Industry* (London: Routledge and Kegan Paul, Ltd., 1953), pp. 77–78.

[5] Stigler, *op. cit.*, p. 188.

also may promote vertical integration. First, because firms are uncertain as to the future prices they may receive for their products, they may welcome the opportunity to integrate their activities with others in return for certainty as to future prices. Vertical integration may not necessarily reduce the total magnitude of price uncertainty in every case, but it often transfers the associated risks. Second, because the cost functions of firms may be interrelated in the manner described above, the income position of each is sensitive to actions taken by the other. In this case, integrating the production activities of otherwise separate firms does provide a method for reducing uncertainty. For example, the processor will face less uncertainty regarding the types of products he receives if he controls some of the decision-making responsibilities for farm production.

But uncertainties of these two types alone may not be sufficient reasons for firms to become integrated with their sources of supply or market outlets. These factors exist in many markets where little or no integration between farming and processing has developed. The influence of uncertainty is related to another market imperfection: the existence of fewness of buyers for the processing crops of individual farmers.

Price uncertainty, to be sure, also exists in markets of many buyers, but is intensified in markets of few buyers. Although firms selling in competitive markets may be dissatisfied with the price they eventually receive, they know that the entire output can always be sold. But for most processing crops there are relatively few buyers in any given locality, and the grower is uncertain whether he will find an outlet for his products regardless of price. Since most fruits and vegetables are very perishable, plant capacity may be overtaxed at peak harvesting periods resulting in lost tonnage.

Besides, in markets of few buyers, canners have strong incentives to control certain aspects of procurement. Ordinarily, when a canner purchases an insignificant amount of the total supply, he can buy as much as he wishes without affecting the price. But in markets of relatively few buyers, this is no longer true. A processor must recognize that price competition at time of harvest will only bid up prices, not increase total supplies. Therefore, rather than be content with playing a passive role in accepting a share of available supply, processors have a strong incentive to make special ties with growers well beforehand. In annual crops, this often means at or near planting time.

Another factor encouraging vertical integration is the desire to reduce certain transfer costs. Whenever ownership of a commodity is transferred, it involves some expense for buyers and sellers. If the successive stages of producing and marketing a commodity are organized within different firms, many such transfers of ownership are required. But if successive stages of production are under a single management, transfer expenses may be reduced.[6] Economies of this sort, however, are not likely to be very great unless imperfect competition exists in buying and selling at various stages of production. Industrial experience indicates that transfer costs reach major proportions when firms are sufficiently few and/or products are differentiated. In such markets, a vertically integrated firm can avoid the costs associated with transferring ownership.

All these factors may encourage agricultural processing firms to become vertically integrated with their sources of supply; they may also encourage farmers

[6] A. C. Hoffman believes that the reduction of transfer expenses is an important cause of vertical integration in many agricultural processing and distributing industries. *Large-Scale Organization in the Food Industries* (Washington: Govt. Print. Off., 1940), 174p. (U. S. Temporary National Economic Committee, Investigation of Concentration of Economic Power, Monograph No. 35.)

to extend their activities into agricultural processing. This study tries to discover the factors underlying the integration of certain farming and processing activities in the tomato canning industry of northern California.[7] Also, it attempts to appraise the effects of grower-processor integration in this industry on its operational and pricing efficiency. The latter requires analysis of the manner in which the pricing process functions in this industry.

SOURCES OF INFORMATION

In addition to published material of federal and state statistical agencies and trade journals of the canning industry, this study was based on a sample survey of California tomato growers and processors. Interviews were conducted during the summer of 1956. In addition, representatives of the Canners League of California, the California Tomato Growers Association, and the California Bureau of Fruit and Vegetable Standardization were consulted concerning their roles in the tomato processing industry.

All major tomato processors in northern California as well as many smaller ones were included in the study. Officials of 29 firms were interviewed; these companies together had 37 tomato processing plants in northern California.[8] [9] The processors interviewed represented about two-thirds of all the companies in the tomato canning business in northern California, and in 1956 they processed tonnage from 86 per cent of the acreage grown in the northern part of the state.

A sample of 116 growers was drawn from the two major producing counties—Yolo and San Joaquin.[10] Although no official statistics are published on the actual number of growers of canning tomatoes in those counties, our own estimates placed the total between 610 and 700. Thus, the sample represented from one-sixth to one-fifth of all the growers in the area. The sample growers had 14,252 acres planted to canning tomatoes during 1956, or 19 per cent of the actual acreage in the two counties.

A narrower range of information, but for a much larger number of growers, was made available to the authors through the California Tomato Growers Association. This large sample of growers was not chosen at random; it is heavily weighted with Association members and is not representative of all growers on that count alone. However, as the only source of data available for such a large number of growers, it was combined with the small grower-sample and used as the foundation for much of the material presented in this report, particu-

[7] For further general discussion of integration, see: Mueller and Norman R. Collins, "Grower-Processor Integration in Fruit and Vegetable Marketing," *Journal of Farm Economics*, vol. XXXIX, no. 5, December, 1957, pp. 1471–1483. Collins and John A. Jamison, "Mass Merchandising and the Agricultural Producer," *Journal of Marketing*, vol. XXII, no. 4, April, 1958, pp. 357–366. Mehren, George L., "The Changing Structure of the Food Market," *Journal of Farm Economics*, vol. XXXIX, no. 2, May, 1957, pp. 339–353. Mehren, "Controls and Supports—Problems and Solutions." Paper delivered at National Agricultural Policy Conference, Turkey Run State Park, Indiana, September 9-12, 1957. Processed.

[8] Actually, they had 39 plants; in two cases two plants were located so close to each other that they were considered as single plants in this study.

[9] Because the scope of the study was restricted to the tomato industry in the northern part of the state, the importance of multiplant firms tends to be understated. If a firm had only one plant which processed tomatoes in northern California, it was regarded for the purposes of this study as a single-plant firm despite the fact that it may have had another tomato plant in the southern part of the state or branch plants that processed other fruits and vegetables.

[10] Throughout this report this sample is referred to as the "small sample of growers" or "small grower-sample."

larly for statements concerning the locational aspects of the industry. Thus the scope of the study, at least on these matters, was expanded from 116 growers in two counties to 746 growers in the twelve-county major production area of northern California (Fig. 1).[11] These growers probably represent about one-half of all canning tomato growers in the region, and they accounted for more than half (53.1 per cent) of the acreage of processing tomatoes grown in this twelve-county area in 1956.

Data provided by the Association did not include information on the location of each grower's acreage. This information was contributed by the Farm Advisors in the 12 counties considered. Because the large sample of growers was not selected at random in accordance with accepted statistical procedure, a serious problem arose in connection with the calculation of distances between growers' fields and processing plants and with determining the significance of the results. This problem and the technique used to solve it are discussed in detail in Appendix A.

Fig. 1. Twelve-county area of northern California important in production of tomatoes for processing.

II. Structural Characteristics of the California Tomato Canning Industry

The background of integration is necessarily very broad. The degree of coordinated action between buyers and sellers in a market depends upon an extremely complex combination of economic and noneconomic forces. Of particular importance are these economic factors: number and size of firms operating on both sides of the market; technical factors such as the number of products usually produced by a firm and the existence of interdependence between revenue-determining functions of buying and selling firms; and the degree of uncertainty due to such factors as weather and substantial time lag between processing and selling dates.

This section describes certain of these forces as they affect the canning tomato industry of northern California and shows the relationship of this market to that of the nation. This information on the structure of the industry is useful not only in itself but as a background for the discussion in Section III which details the extent and form of coordinated activity developed between tomato growers and processors.

[11] Throughout this report the latter sample is referred to as the "large sample of growers" or "large grower-sample."

CHARACTERISTICS OF THE DEMAND STRUCTURE FOR CALIFORNIA CANNING TOMATOES

The demand for processing tomatoes at the farm level is far removed in complexity from the simple demand function of elementary economic theory. The latter concept is a simple, reversible relation between the price of the product and the quantity the buyer is willing to purchase. It is assumed that the commodity in question is demanded by similar buyers who intend to use it for similar purposes. In fact, processing firms in California use tomatoes in the production of a wide variety of final and semifinished products; in addition, there is some interaction between tomatoes for processing and those for the fresh market.[12] The demand for raw tomatoes in California is complicated further by the fact that California processing firms are selling their products in a national market. Thus, these firms have to compete with those in other major producing areas, and that competition is translated back to the farm level in this state.

Market outlets for processed products

The "demand" for processed tomato products is actually a collection of demands for items which in many respects have quite dissimilar uses. The important forms in which the national processing tomato output is marketed are: whole tomatoes, juice, paste, sauce, catsup, and puree. The bulk of the output of catsup, juice, and whole tomatoes passes into normal wholesaling and retailing channels to be sold to final consumers. Tomato paste, sauce, and puree, on the other hand, have major outlets in remanufacturing industries as ingredients for other foods. In 1955, over one-half of California's production was used for these latter products (Table 1).

California's relative importance in the national pack. The California canning industry is the chief source of the nation's tomato products (Table 2). In the years 1954–1956, almost half of the total supply of tomato puree, catsup, and chili sauce was produced in California. Even more striking is the relative importance of the state's output of tomato paste and sauce which represents 94 per cent of the national pack. Although California produces a somewhat lower proportion of the nation's supply of canned whole tomatoes, it is by far the largest single producer with 38 per cent of the United States output. The next two largest suppliers, in order, are Maryland and Indiana with 21 and 8 per cent of the market respectively. Although these figures establish California as the major producer of processed tomato products in the nation, their significance from the point of view of the raw product in this state is that a substantial proportion of the market in which California

Table 1. Per Cent of California Production of Processing Tomatoes Consumed in Production of Specified Tomato Products, 1955

Tomato product	Per cent*
Whole tomatoes	10
Juice	12
Paste	34
Sauce	14
Catsup	16
Puree	4

* Column adds to 90 per cent. Other minor products account for the remaining 10 per cent of production.

Source: Hoos, Sidney, "Tomatoes and Tomato Products—Economic Trends and F.O.B. Price Relationships" (Berkeley: University of California, Agricultural Experiment Station, March, 1956.) Table 5. (Giannini Foundation Mimeographed Report No. 185.) Processed.

[12] Hoos, Sidney, *Tomatoes and Tomato Products—Economic Trends and F.O.B. Price Relationships* (Berkeley: University of California, Agricultural Experiment Station, March, 1956) p. 1 (Giannini Foundation Mimeographed Report no. 185) Processed.

processors sell is supplied by processors in other states.

Trends in per capita consumption. Both processors and growers in the California processing tomato industry have developed an expansionary outlook as a result of the tremendous growth of demand for tomato products in the last few decades. This expansion is the result not only of rising population and incomes in the United States but also of the fact that tomatoes and tomato products have become increasingly important in the diets of American consumers. The general level of per capita tomato consumption has risen by more than three-fourths in the last 30 years (Table 3). The upward trend, furthermore, is much more marked for processed tomatoes than for those in fresh form, although all processed products have not shared equally in the increase. The most strongly favored are tomato juice, sauce, and paste. Canned whole tomatoes are the only product to exhibit a decline. Per capita consumption of pulp and puree has remained fairly stable while a rising trend is evident for catsup and chili sauce.[13]

The trends in per capita consumption have thus been toward the more highly concentrated products. Since transportation costs are important to California processors selling in eastern markets, this has enhanced the competitive position of the West Coast industry. A typical tomato canner in California can convert one ton of raw tomatoes into 55.5 cases of canned whole tomatoes or, alterna-

Table 2. Output of Processed Tomatoes and Tomato Products, United States and California, Annual Average of 1954–1956

Product	Production		California production as percentage of United States
	United States	California	
	thousands of actual cases		per cent
Total	98,473	50,627	51.4
Whole tomatoes	24,440	9,313	38.1
Tomato juice	28,394	12,158	42.8
Tomato paste	6,928	6,825	98.5
Tomato sauce	8,692	7,818	89.9
Tomato chili sauce	2,556	1,196	46.8
Tomato catsup	23,938	11,209	46.8
Tomato puree	3,525	2,108	59.8

Sources:
United States data: Tomato paste—Western Canner and Packer, "Statistical Review and Yearbook Number," May 25, 1957, p. 187.
Other products—National Canners Association, "Canned Food Pack Statistics," 1956 (Washington, D.C.: 1957), pp. 31–36.
California data: Canners League of California, "1956 Summary, California Pack Statistics," February 2, 1957, pp. 7–8.

[13] The foreign market is relatively important for certain processed tomato products. During the five-year period, 1950–1954, the export market took an average of 1 per cent of the United States canned whole tomato pack, 4.3 per cent of the pack of catsup and sauces, 4.1 per cent of paste, and 3.2 per cent of the industry's output of tomato juice. [U. S. Department of Agriculture, *Agricultural Statistics*, 1955 (Washington: Govt. Print. Off., 1955), pp. 245 and 251. Cases converted to pounds by factors from U. S. Production and Marketing Administration, *Conversion Factors and Weights and Measures for Agricultural Commodities and Their Products* (Washington, D.C.: 1952)]. Certain California canners have been interested recently in expanding the production of a more highly concentrated paste product for sale in the export market.

Table 3. Per-Capita Consumption of Tomatoes and Tomato Products, United States, Three-Year Annual Averages, 1924–1926 to 1954–1956

Year	Tomatoes and tomato products, total	Fresh, total	Processed					
			Total	Canned whole tomatoes	Tomato catsup and chili sauce	Tomato paste and sauce	Tomato pulp and puree	Tomato and other vegetable juices
	pounds per capita, net farm weight equivalent							
1924–1926	29.7	11.7	18.0	12.5	1.9	1.5	2.1	0
1929–1931	33.5	12.9	20.6	11.5	4.7	1.3	2.6	0.5
1934–1936	35.6	13.4	22.2	10.7	4.2	2.1	2.4	2.8
1939–1941	42.0	13.5	28.5	11.2	6.3	3.8	2.0	5.2
1944–1946	55.9	15.3	40.6	8.2	6.4	11.5	6.1	8.4
1949–1951	50.8	13.2	37.6	9.2	6.8	11.9	2.2	7.5
1954–1956	53.0	12.5	40.5	8.7	7.9	13.6	2.2	8.1

Sources: U. S. Agricultural Marketing Service, "The Vegetable Situation," July, 1957, 43p. Processed. Data for specific processed products were converted from canned weight to farm weight equivalent by factors given in: U. S. Production and Marketing Administration, "Conversion Factors and Weights and Measures for Agricultural Commodities and Their Products" (Washington, D.C., 1952), p. 74.

tively, into only 12.3 cases of tomato paste.[11] This is an important reason why more than twice as many California tomatoes go into paste than into any other tomato product.

Nature of the processing segment of the industry

Multiple-product processing. The California tomato canning industry is characterized by multiple-product firms both in the sense that they process more than one tomato product and that they also can products other than tomatoes (Table 4). This is in sharp contrast with the situation in other important processing states (Table 5). For example, Maryland and Virginia firms are highly specialized in canned whole tomatoes (Table 6). In New Jersey the production of

Table 4. Frequency Distribution of California Tomato Processing Firms by Number of All Products and by Number of Tomato Products* Processed, 1955

Number of all products	Number of firms	Number of tomato products	Number of firms
Total	57	Total	57
1–5	8	1	10
6–10	23	2	10
11–15	10	3	12
16–20	5	4	12
21–25	1	5	6
26–30	3	6	6
31–35	2	†	1
36 or more	5		

* The six tomato products considered are: whole tomatoes, juice, puree, paste, sauce, and catsup.
† Not specified.
Source: Descriptions of individual firms shown in: Western Canner and Packer, "United States Food Products Directory, 1955" (Miller Freeman Publications: 1955), vol. XIII.

Table 5. Frequency Distribution of Tomato Processing Firms by Number of Tomato Products* Processed, Ten States, 1955

State	Number of firms which process specified number of tomato products							
	Total	1	2	3	4	5	6	Not specified
	number							
California	57	10	10	12	12	6	6	1
Illinois	30	14	11	1	2	0	0	2
Indiana	91	33	29	16	11	1	1	0
Maryland	124	109	9	2	4	0	0	0
New Jersey	33	15	13	5	0	0	0	0
New York	61	19	29	7	4	1	0	1
Ohio	59	30	16	6	6	1	0	0
Pennsylvania	54	42	8	3	1	0	0	0
Texas	46	20	11	10	4	1	0	0
Virginia	73	70	2	0	0	1	0	0

* The six tomato products considered are: whole tomatoes, juice, puree, paste, sauce, and catsup.
Source: Descriptions of individual firms shown in: Western Canner and Packer, "United States Food Products Directory, 1955" (Miller Freeman Publications: 1955), vol. XIII.

[11] Hoos, *op. cit.*, p. 34.

whole tomatoes and puree is emphasized. Very few firms other than those in California process any paste or sauce. Not many canneries in other states process more than two tomato products, while almost two-thirds of the California processors do so. This compares with about one-third for Texas and Indiana firms and far less than a fourth for all other states.

Striking differences also exist in the number and kinds of other foods processed by tomato canners in various sections of the country (Table 7). In Texas, a relatively large number of firms process citrus products. Beans and variety products such as chili and Mexican specialties are also produced by about a third of the Texas tomato canners. Deciduous fruits and berries are important lines for California and New York firms. New York is the only state where production of frozen foods is an important activity of tomato processors. In all states other vegetables are processed by a substantial proportion of the tomato canners.

The difference between diversification patterns of California firms and those of other areas which was noted above for tomato products alone is equally marked when all products are considered. California tomato canners process an average of 15.5 products of all kinds. Next in rank are Illinois and Texas, with 10.6 and 10.3 products per firm respectively. These data suggest that the California tomato processing industry has a much wider market orientation than its counterparts in other sections of the country. Characteristically, West Coast canners enter the market with a larger number of processed tomato products and a more complete line of other canned fruits and vegetables. The typically large size of their tomato operations permits them to realize efficiencies in the internal organization of their plants. In contrast with the specialized tomato canners in the East, California firms operate for a substantial part of the year. Thus, a higher degree of mechanization is possible since much of the equipment can be used for other products as well. These year-round, large volume operations have made it possible for California tomato processors to organize highly trained field departments. Much of the coordination of grower-processor activities discussed later is carried on by these field staffs.

Table 6. Number of Firms Which Process Specified Tomato Products, Ten States, 1955

State	Tomato products						
	Total	Whole	Juice	Puree	Paste	Sauce	Catsup
	Number of firms						
California	57	48	28	34	25	27	18
Illinois	30	20	10	8	1	2	6
Indiana	91	84	53	33	2	2	20
Maryland	124	122	12	8	2	2	3
New Jersey	33	29	4	13	1	3	6
New York	61	44	43	17	4	3	9
Ohio	59	54	22	19	2	2	10
Pennsylvania	54	44	12	7	0	3	5
Texas	46	44	16	21	2	6	4
Virginia	73	73	3	1	0	1	1

Source: Descriptions of individual firms shown in: Western Canner and Packer, "United States Food Products Directory, 1955" (Miller Freeman Publications: 1955), vol. XIII.

Table 7. Number of Tomato Processing Firms Which Process Other Foods, by Food Group, Ten States, 1955

State	Food groups										
	Total	Citrus fruits	Other fruits	Berries	Truck crop vegetables	Field crop vegetables	Beans and bean products	Fish	Variety products	Frozen foods	Dried foods
	number of firms										
California	57	4	45	10	39	16	5	3	27	5	7
Illinois	30	0	6	4	14	9	8	2	13	2	5
Indiana	91	0	1	0	21	19	11	0	8	0	0
Maryland	124	0	6	2	43	22	16	5	12	5	2
New Jersey	33	0	3	7	13	18	7	1	13	1	4
New York	61	0	36	12	35	15	10	1	19	29	1
Ohio	59	0	5	1	10	14	3	0	10	3	1
Pennsylvania	54	0	11	1	28	13	9	1	15	3	1
Texas	46	18	3	5	29	32	13	0	17	2	3
Virginia	73	0	10	1	13	8	5	5	3	0	0

Source: Descriptions of individual firms shown in: Western Canner and Packer, "United States Food Products Directory, 1955" (Miller Freeman Publications: 1955), vol. XIII.

Size and location of California tomato processing plants. Most of the California tomato processing firms are in the northern part of the state. Only about a fifth of them operate tomato canning plants in southern California (south of San Luis Obispo and Kern counties); most of these are near Los Angeles or even farther south. Less than 10 per cent of the state's acreage of canning tomatoes is in southern California, so the tomato operations of these firms are relatively smaller than in the north. They process fewer tomato products on the average and produce a narrower general line than tomato canners in the state as a whole. Southern firms tend to process, in addition to their tomato output, such specialty items as pickles, relishes, extracts, and similar variety products. Northern firms typically can the standard packs of fruits and vegetables such as peaches, apricots, and asparagus.

These northern California firms, comprising the bulk of the industry, are the focus of this study. There are approximately 45 of these canners. This study obtained information on the largest 40 firms; only 29 canners were directly interviewed, however. These 40 account for virtually all of the acreage grown in the twelve-county area (shown in Fig. 1) which effectively delimits the major producing region in northern California. It should be noted that a few of these firms also contract some acreage beyond the boundaries of this region—for example, in the Merced area or in Contra Costa, Butte, or Colusa counties which were not included in the scope of this study. Thus, discussion on the relative size of plants or other aspects of these firms is based only on the data concerning tomatoes obtained within this twelve-county area. As the production region encompassed by these 12 counties accounted for 95 per cent of the northern California production of canning tomatoes in 1956, this restriction has very little effect on our conclusions.

These 40 firms have 49 plants which process tomatoes in northern California.[15] They are almost all located within the twelve-county producing area. A few are just beyond the boundary but nevertheless obtain their acreage largely from within the region. For convenience, and also to protect the identities of individual firms, these plants have been grouped by location into eight major processing centers: (1) Sacramento, (2) Antioch, (3) Stockton, (4) Manteca, (5) Modesto, (6) Oakland, (7) San Jose, and (8) Hollister (Fig. 2). These designations are general rather than specific. The Sacramento center, for example, embraces not only plants in that community but a few isolated plants in other northern cities. Similarly, the fourth processing center, Manteca, includes plants in the entire southern San Joaquin County-northeastern Stanislaus County region. Thus, cities as far west as Tracy and as far east as Oakdale would be considered part of the

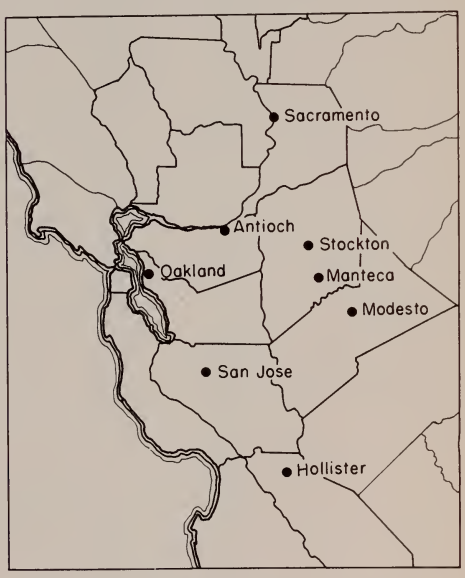

Fig. 2. Eight major processing centers in northern California

[15] Actually 51 plants, but in two cases, two plants located very near each other were considered as single plant units in this study.

Manteca complex. The Stockton center includes firms in other northern San Joaquin County cities, and the Oakland group is comprised of plants in the Bay Area.

The size of plants, with respect to their tomato operations alone, varies considerably from those that take 300 acres or less to those that process tomatoes from more than 10,000 acres in a season. The average for all 49 plants is 2,612 acres, and about two out of three contract for less than this amount. The largest plants, as far as tomato purchases are concerned, are in the Oakland and Sacramento processing centers; on the average, they processed tomatoes from well over 4,000 acres during the 1956 season (Table 8). The plants that purchase fewest tomatoes are in the San Jose and Hollister centers, although the San Jose average is strongly affected by the presence of a number of firms that might be considered marginal in tomato processing. Some of these firms are large and quite diversified, and their tomato operation is only a minor sideline. Plants located in the Central Valley (Stockton, Manteca, Modesto, and Antioch) are slightly smaller than the average. They also tend to be more heavily dependent on tomato processing.

Raw product procurement: concentration and purchasing patterns. More than one-third of the acreage grown in the twelve-county area is contracted by firms in the Oakland and San Jose processing centers (Table 8). The great importance of these two processing centers, in terms of tomato tonnage handled, is in sharp contrast with the relatively small tonnage that is produced on acreage in their vicinity. There are a number of factors responsible for this. Many of these plants, in operation for 20 or 30 years or more, were originally located close to the main tomato producing areas, but the centers of production have moved away. Also, the plants in Oakland and San Jose are typically large and diversified and tend to process a general line of fruit and vegetables, many of which are available in the vicinity; thus, their locational disadvantage is not so great as it might appear from the tomato situation alone. Good transportation facilities, the presence of related supplier industries, and the availability of an experienced labor supply, also favor these two

Table 8. Number of Tomato Processing Plants and Acreage Contracted by Them (in the Twelve-County Producing Area) for Eight Processing Centers in Northern California, 1956

Processing centers	Number of plants	1956 acreage contracted	Percentage distribution of acreage contracted	Average acreage contracted per plant
	number	acres	per cent	acres
Total	49	128,000	100.0	2,612
1. Sacramento	6	26,149	20.4	4,358
2. Antioch	4	8,400	6.6	2,100
3. Stockton	8	20,590	16.1	2,574
4. Manteca	5	11,297	8.8	2,259
5. Modesto	5	10,619	8.3	2,124
6. Oakland	7	30,188	23.6	4,313
7. San Jose	10	14,157	11.1	1,416
8. Hollister	4	6,600	5.1	1,650

Source: Confidential data provided by industry sources, chiefly processor interviews covering 29 firms with 37 plants. (See p. 8 for fuller description of processor sample.)

areas as tomato processing locations.

The firms in this region, of course, would prefer to obtain more tomatoes in the neighborhood of their plants, but the relative shortage of such supplies forces them to haul from greater distances. For example, during the 1956 season, only some 5,000 acres of canning tomatoes were grown in the vicinity of these plants; any one of at least five plants in the Oakland and San Jose centers required at least half this amount. The difficulties faced by these canners are even greater than the acreage discrepancy indicates. Processors interviewed in Oakland and San Jose also mentioned the comparatively low yields in Alameda and Santa Clara counties, the disease problems, the fact that the land has been used for so many years it is "worn out" for tomatoes, and the increasing use of land for residential construction which has affected land values.

When the tonnage required by each processing center is compared with the acreage grown in its immediate production area, it is evident that the Oakland-San Jose region is the only one with a serious deficit in tomato supplies. No major processing plants are located in the Marysville, Napa, and Monterey areas; thus, these are regions with surplus tonnage. Plants in the Manteca and Antioch centers do not absorb the full production of the Tracy and River areas, so these two districts also have some surplus tomatoes. The remaining areas are pretty evenly balanced with the tonnage produced just about equal to that processed by local canners.[16] Tomatoes from surplus producing areas tend to be hauled greater distances than those from balanced areas, which in turn are hauled on the average farther than those from deficit areas. The surplus producing regions of Marysville, Napa, and Monterey ship their tomatoes an estimated average of 51, 81, and 56 miles, respectively (Table 9). The average distance traveled in the Oakland-San Jose producing region is only 10 miles.

Each processing center tends to acquire the largest single portion of its acreage in its home area (Table 10). Since hauling distance and hauling costs are directly correlated, this pattern of buying indicates that all companies wish to minimize field-to-plant distance in order to keep costs low. However, some firms are much more sensitive than others in this regard.

Of the 29 processors interviewed, 14 regarded hauling costs as highly important. Eight of these had plants that hauled their tomatoes less than 15 miles on the average—the lowest average distances in the entire industry; four others, in the San Jose processing center, hauled long distances, but managed to achieve distances substantially shorter than the average for all San Jose plants.

Six of the 29 firms regarded hauling costs as relatively unimportant. All these firms had plants that hauled their toma-

Table 9.
Average Distance (Weighted by Acreage) From Grower's Field to Processing Plant for Ten Production Areas of Northern California, 1956

Production area	Average distance*
	miles
Total	31 (30–38)
1. Marysville	51 (51–81)
2. Napa	81 (81–81)
3. Sacramento	30 (29–40)
4. River	37 (36–37)
5. Stockton	19 (18–30)
6. Tracy	34 (30–34)
7. Westside	31 (28–45)
8. Oakland–San Jose	10 (9–22)
9. Gilroy–Hollister	10 (10–14)
10. Monterey	56 (56–60)

* The ranges enclosed in parentheses refer to distance estimates calculated on the basis of minimum and maximum allocation of acreage as described in Appendix A.

Source: Data from large sample adjusted to area and company totals by means described in Appendix A.

[16] For a description of production areas, see Appendix B.

Table 10. Percentage of Each Processing Center's Canning Tomato Acreage Requirements Obtained in Specified Production Areas, Eight Processing Centers and Ten Production Areas of Northern California, 1956

Production areas	Processing centers							
	Sacramento	Antioch	Stockton	Manteca	Modesto	Oakland	San Jose	Hollister
	per cent							
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1. Marysville	23.2	1.6	0.3	1.1		6.2	2.8	
2. Napa							5.1	
3. Sacramento	73.8*	15.0	11.1	4.6	1.3	17.3	2.2	
4. River	3.0	46.8*	24.3	6.0	17.3	23.8	4.5	4.5
5. Stockton		10.8	55.1*	24.6	30.2	4.7	12.8	
6. Tracy		21.7	9.2	38.8*	14.3	32.0	34.2	
7. Westside		3.6		24.9	36.9*	7.6	3.4	5.7
8. Oakland–San Jose		0.5				8.4*	19.8*	
9. Gilroy–Hollister							6.2	61.9*
10. Monterey							9.0	27.9

* Home area for each processing center.
Source: Data from large sample adjusted to area and company totals by means described in Appendix A.

Table 11. Average Distance* (Weighted by Acreage) from Production Areas to Processing Centers, Ten Production Areas and Eight Processing Centers of Northern California, 1956

Production areas	Processing centers								
	Total	Sacramento	Antioch	Stockton	Manteca	Modesto	Oakland	San Jose	Hollister
	distance in miles								
Total	31 (30–38)	19 (19–20)	31 (28–32)	17 (16–24)	20 (18–33)	28 (25–38)	50 (50–55)	47 (46–63)	21 (21–34)
1. Marysville	51 (51–81)	29 (29–38)	70 (70–70)	48 (48–48)	112 (112–112)		101 (101–105)	124 (124–128)	
2. Napa	81 (81–81)							81 (81–81)	
3. Sacramento	30 (29–40)	17 (17–17)	43 (43–44)	36 (31–56)	74 (74–74)	64 (64–64)	67 (67–68)	88 (88–89)	
4. River	37 (36–37)	12 (12–18)	26 (26–30)	20 (20–20)	46 (46–46)	58 (58–59)	47 (47–49)	65 (63–65)	107 (107–107)
5. Stockton	19 (18–30)		28 (25–28)	9 (8–9)	18 (18–19)	17 (16–22)	56 (52–56)	52 (51–52)	
6. Tracy	34 (30–34)		28 (25–32)	31 (28–31)	7 (6–10)	33 (29–33)	42 (42–43)	44 (43–44)	
7. Westside	31 (28–45)		53 (53–53)		19 (19–21)	21 (18–21)	54 (54–58)	38 (37–38)	52 (52–52)
8. Oakland–San Jose	10 (9–22)		21 (21–21)				9 (9–25)	10 (9–13)	
9. Gilroy–Hollister	10 (10–14)							34 (32–34)	5 (5–6)
10. Monterey	56 (56–60)							86 (86–86)	35 (35–43)

* The ranges enclosed in parentheses refer to distance estimates calculated on the basis of minimum and maximum allocations of acreage as described in Appendix A.
Source: Data from large sample adjusted to area and company totals by means described in Appendix A.

toes long distances; that is, the average mileage traveled by each plant's supplies was larger than the general average for all plants in its own processing center. Four of these six firms, in fact, hauled their tomatoes an average distance of well over 50 miles—farther than any others in the industry.

The companies for which hauling costs were not of paramount concern tended to be larger and more diversified than average, while those to which hauling costs were considered crucial typically had smaller, less diversified operations. For these smaller firms which are rather dependent on tomato processing, hauling costs are a substantial component of total costs. These companies shy away from acreage distributions (or purchasing patterns) that increase hauling costs because the effect on total cost is significant.

As Table 10 shows, the various processing centers differ considerably in the proportion of their needs that is met in their home areas. There are two important reasons for this: (1) as we shall see in Section III, most companies follow a deliberate policy of dispersing their purchases over a number of areas rather than one of strictly minimizing hauling distances; and (2) as pointed out above, some companies are located in deficit production areas and are unable to purchase as many tomatoes near their plants as they would like. The Sacramento, Stockton, and Hollister centers are perhaps most fortunate in this respect; they obtain more than half their requirements in their home areas. Plants in these centers have achieved hauling distances at least 10 miles lower than the over-all average for the entire industry (Table 11). Plants in the Manteca center, too, haul their supplies only about 20 miles. Although they do not obtain half their requirements in their home area, Tracy, two other rich areas, Stockton and Westside, are strategically close to them. From these three areas, they receive almost nine-tenths of their tomatoes. These Sacramento, Stockton, Hollister, and Manteca plants contract in only four areas, on the average, and achieve hauling distances substantially lower than average.

Plants in Antioch and Modesto are more on the fringe of the rich producing areas than those described above. They acquire less than half their needs in their home areas, and they disperse their purchases, contracting in an average of six areas. They haul their tomatoes about 30 miles—very close to the industry average.

Firms in Oakland and San Jose, the only processing centers unable to obtain the largest single portion of their requirements in their home areas, acquire less than one-fifth of their needs near their plants. They are forced to depend on the Tracy region for the main part of their supply, contracting about one-third of their acreage there. Since these plants must reach out beyond their home area, the Tracy region is their best alternative. The magnitude of their supply problem is illustrated by the facts that even the Tracy area is 43 miles away, and that they have to disperse their purchases very widely: among seven areas for Oakland, and among 10 areas for San Jose canners. All these factors contribute to substantially higher hauling costs for these firms. While the average hauling distance is 31 miles for the entire industry and only 21 miles for plants in all other locations, for Oakland-San Jose firms it is almost 50 miles, or more than double that of processors in other centers.

Although no one company dominates the market, concentration of buying is rather pronounced. Almost two-fifths of the acreage is purchased by the five largest firms, and one-fourth of the firms take almost three-fifths of the acreage (Fig. 3). At the opposite end of the scale, the 10 smallest firms account for less than 5 per cent of the purchases.

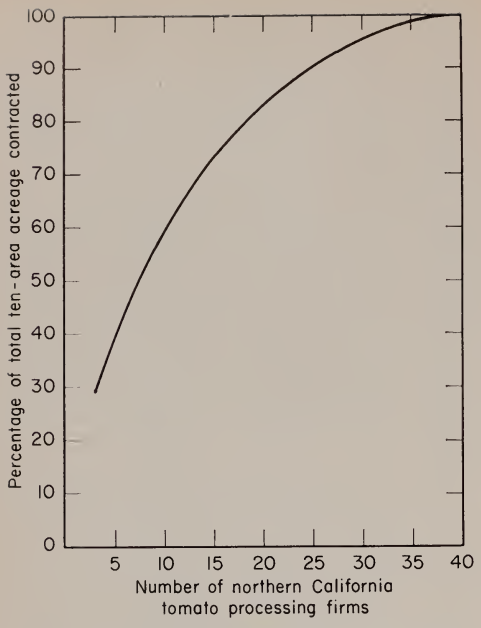

Fig. 3. Cumulative distribution of northern California tomato processing firms by percentage of total ten-acre acreage contracted, 1956.

In particular production areas, concentration is even more striking. For example, in the Napa area virtually all the acreage is contracted by one firm. Only six companies purchase any acreage in the Monterey region (Fig. 4). In general, for all production regions there is an inverse relationship between the degree of purchase concentration and the amount of acreage grown (Table 12).[17] This would seem to indicate that a wider selection of canners is available to growers in the main producing area. However, this does not seem to have had a significant influence upon terms offered to growers in the various areas. As will be seen in Section III, a great deal more significance is attached to the over-all purchase concentration in the entire 10 producing areas combined.

Organization of buyers. The Canners League of California, a trade organization representing most of the processing firms, was formed in 1905 and presently has more than 40 members. About 85 per cent of the total California fruit and vegetable pack is processed by members of the League. The 29 member firms that purchase tomatoes account for more than two-thirds of the state's acreage of canning tomatoes and for almost four-fifths of the acreage grown in the twelve-county producing region of interest in this study.

The Canners League is not a market-

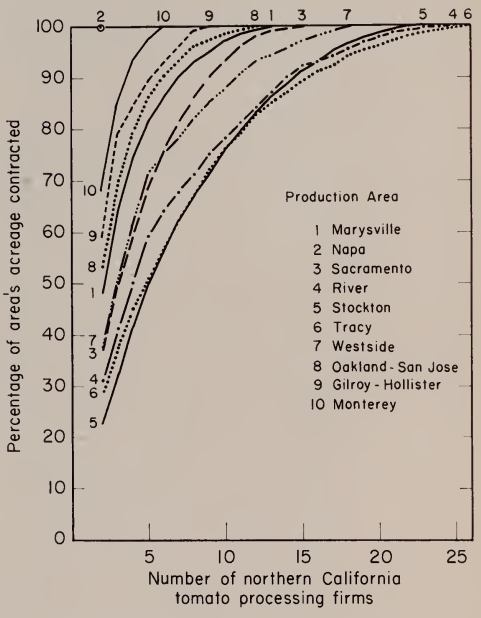

Fig. 4. Cumulative distribution of northern California tomato processing firms by percentage of total acreage contracted in each of ten production areas, 1956.

[17] In this study, the degree of purchase concentration in an area was measured by the number of firms contracting 85 per cent of the area's acreage. The lower this number, the higher is the degree of purchase concentration. The inverse relationship would be perfect were it not for the Sacramento area which ranks higher in concentration than would be expected. The Sacramento canning plants are very well located in the heart of this area, especially in comparison with plants in other processing centers which are well over twice the distance away. These plants are also the heaviest consumers of tomatoes in the industry, so their substantial requirements tend to absorb a large proportion of the acreage in the Sacramento area. In fact, they take two-thirds of the available acreage in this district which is the largest of all the production areas.

ing organization nor a collective bargaining agency for canners' procurement. Its major effect on industry buying practices results from making available a contract form. Use of the League's contract form is not a condition of membership, but only a few of the larger companies use distinctively different forms of their own.

Most of the activities of the Canners League are in the sphere of public relations. The League acts as a spokesman for the industry before governmental agencies. It encourages the exchange of ideas among growers and canners by means of "clinics" set up for the discussion of common problems. It attempts to improve quality by sponsoring annual meetings to examine samples of products packed by members. It also collects statistics on the processing industry which are made available to the public. Of a more direct service nature is its program to protect the box investment of member canners. Since the early 1930's, representatives of the Canners League have collected and sorted misplaced boxes and returned them to their owners.

Demand for Processing Tomatoes at the Farm Level

In discussing demand for processing tomatoes at the farm level, it would be most desirable to determine the net price-quantity relationship facing the producer. However, the structure of the canning industry, and the kinds and extent of uncertainty facing the industry, make the attainment of such precision practically impossible. Accordingly, the important general attributes of demand are summarized here without attempting to derive their precise quantitative expressions.

Many writers use the term "derived demand" to suggest that producer-level demand is obtained by subtracting processing and distribution costs from retail prices. The term "derived" suggests an important element of truth as ultimate

Table 12. Relationship Between Degree of Purchase Concentration and Acreage of Tomatoes for Processing, Ten Production Areas of Northern California, 1956

Production area	Area's rank in	
	Degree of purchase concentration*	Acreage of tomatoes for processing†
Napa	1	10
Monterey	2	9
Gilroy–Hollister	3	8
Oakland–San Jose	4	7
Marysville	5	6
Sacramento	6	1
Westside	7	5
River	8	4
Stockton	9	3
Tracy	10	2

* In this study, the degree of purchase concentration in an area is measured by the number of firms contracting 85 per cent of the area's acreage. The lower this number, the higher is the degree of purchase concentration. The ranks shown in this table for purchase concentration are based on the intermediate assignment of acreage (see Appendix A). When the maximum and minimum acreage allocations were used, the ranks were reversed in only a few instances and the general inverse association between purchase concentration and acreage was confirmed.

† The area with the most acreage has a rank of 1, etc.

Source: Purchase concentration based on data from large sample adjusted to area totals by means described in Appendix A. Acreage: Table 17.

consumer demand is a basic determinant of farm demand. But actually we face the aggregation of a number of quite separate consumer demands. Important outlets for the raw processing tomato crop include paste, juice, sauce, whole tomatoes, catsup, and puree. Of the few studies estimating price elasticities for the demands of these products, one concluded that the retail price elasticity for canned tomatoes was relatively low (−.4).[18] For tomato juice, it may be slightly higher. Demand at the farm level is commonly even less elastic than at retail. Remanufacturers' demands for tomato paste and sauce probably are also relatively inelastic since they represent minor proportions of the foods in which they are used.

The term "derived" implies that processing and distribution costs must be considered in determining farm demand. These costs represent an important component of the retail bill for most agricultural commodities including processed tomato products. Processing costs alone account for almost half of the retail price of canned tomatoes.[19] Their effect on demand at the farm level is that the price elasticity coefficient tends to become smaller as these amounts paid for processing and distribution increase.

This view of farm demand is an oversimplification. It attributes a passive role to the processing and distributing firms in determining the payments made for the performance of their functions.[20] It implies that competition forces these firms simply to deduct from consumer payments the amount necessary to cover the costs of doing business. The data previously presented suggest that the purchasing of tomatoes for processing may be sufficiently concentrated in the hands of relatively few buyers to render unwarranted the assumption that consumer demand is translated back to the farmer in any direct or simple fashion. When there are only a limited number of tomato processing outlets available to growers, buyers can be expected to exercise a measure of discretion over their purchase terms.

To consider farm demand as mechanistically "derived" from consumer demand is liable to the additional criticism that the time dimension is ignored. The concept assumes that consumer demand is immediately translated to the primary production level by the appropriate subtraction of processing and distribution costs. All the elements necessary to compute the margin are assumed to be known. Actually, however, consumer demands for processed tomato products are not known with certainty for as long as a year after the canning date. Most California canners do not make definite sales commitments much in advance of actual delivery. These same canners, however, make specific contractual arrangements with growers, including both price and quantity provisions, prior to planting time. Thus, the important aspects of farm demand must be determined without complete information either on consumer demand or on processing and distribution margins. The uncertainties of forecasting consumer demand, inventory conditions, and process-

[18] Shuffett, D. Milton, *Demand and Price Structure for Selected Vegetables* (Washington: Govt. Print. Off., 1954), p. 110. (U. S. Department of Agriculture Technical Bulletin 1105.)

The coefficient of price elasticity, as used by the economist, means the ratio of the relative change in quantity taken of a commodity to the corresponding relative change in price. The coefficient of -.4 indicates that, on the average, a 4 per cent increase in quantity consumed will result from a decline in price of 10 per cent.

[19] U. S. Bureau of Agricultural Economics, *The Marketing and Transportation Situation* (Washington, D. C.: August, 1950). (MTS-87.)

[20] Fox, Karl A., *The Analysis of Demand for Farm Products* (Washington: Govt. Print. Off., 1954), p. 18. (U. S. Department of Agriculture Technical Bulletin 1081.)

ing costs are great.[21] Added to these are the uncertainties in predicting the level of supplies forthcoming from the other major producing regions. In recent years, adverse weather conditions at harvest time have contributed to rather large fluctuations in the production of eastern states.

These factors suggest that consumer demand is not translated back to farm-level demand in any simple manner. Moreover, the quantity of farm product demanded cannot be expressed in terms of price alone. In a perfectly competitive market, price is assumed to be the mechanism that coordinates the decisions and activities of farmers and processors. But there are other factors in the demand picture for canning tomatoes; consequently, the function of price as a coordinator of demand and supply is diminished. These other factors involve such items as box rental payment, hauling allowances, granting of credit, and giving of advice and technical assistance by cannery fieldmen. As the farmer views his market, all of these factors enter into his determination of the profitability of tomato production.

CHARACTERISTICS OF THE SUPPLY STRUCTURE FOR CALIFORNIA CANNING TOMATOES

Production of tomatoes for all uses is a very important agricultural industry in California. This state grows about one-half of all the tomatoes produced in the United States (Table 13). During the years 1954–1956, California's annual production averaged more than 2 million tons, while the United States figure was about 4.5 million tons. The great bulk of the state's tomato crop is used for processing; less than one-eighth is sold on the fresh market. This does not mean that California is unimportant as a source of fresh tomatoes, however. Although tomatoes destined for market in an unprocessed form are only a small share of the state's total production, they represent more than 25 per cent of the total United States crop of fresh tomatoes.

Because the state possesses a variety of climatic conditions, tomatoes are produced year-round in California, with the smallest production in March. The southern desert regions have a unique importance at this time since they can help to supply the fresh market during the winter and early spring when other areas in the state are out of production. The height of the fresh market season occurs from June to November; during the last two months of that period, California is the chief source of supply for eastern markets. Most of the state's shipping tomatoes are referred to as "greens" or "green wrap" because they are harvested in the green stage, wrapped, and then shipped to their destinations where they are ripened prior to their sale to consumers. The fully ripe fruits are sold locally. By far the most important production period for all tomatoes is early fall, partly because this is the time of the heaviest production for fresh market, but chiefly because the very large crop of canning tomatoes also is harvested then. All producing areas of the state harvest tomatoes in the fall, with the northern San Joaquin Valley and the southern Sacramento Valley contributing the major share. In general, southern California—the coast as well as the interior

[21] Farm demand in any given year is affected substantially by the level of inventories. It is not uncommon for canners' stocks to range between 30 and 50 per cent of the annual pack immediately prior to harvesting. In some years, the carry-over is virtually zero at this time. The elasticity of demand at the farm level is probably greater in those years when canners are holding large inventories. See: *Ibid.*, p. 20, for a discussion of this point.

Table 13. Acreage, Production, and Yield of Tomatoes, Total, for Fresh Market, and for Processing, United States and California, Annual Average of 1954–1956

	Acreage			Production			Yield		
	Total	Fresh market	Processing	Total	Fresh market	Processing	Total	Fresh market	Processing
	acres			tons			tons per acre		
United States	546,747	233,237	313,510	4,526,094	1,009,967	3,516,127	8.3	4.3	11.2
California	151,367	36,100	115,267	2,305,617	274,850	2,030,767	15.2	7.6	17.6
	per cent								
California as percentage of United States	27.7	15.5	36.8	50.9	27.2	57.8	183.1	176.7	157.1

Sources:
U. S. Agricultural Marketing Service, "Vegetables—Fresh Market, 1956 Annual Summary" (Washington, D.C.: 1956), pp. 47–48. Processed.
U. S. Agricultural Marketing Service, "Vegetables—Processing, 1956 Annual Summary" (Washington, D.C.: 1956), p. 16. Processed.
U. S. Agricultural Marketing Service, "Vegetables for Fresh Market, Acreage, Production, and Value, 1949–1955, Revised Estimates" (Washington, D.C.: 1957), pp. 104–106. (Statistical Bulletin No. 212.)
U. S. Agricultural Marketing Service, "Vegetables for Processing, Acreage, Production, and Value, by States, 1949–1955, Revised Estimates" (Washington, D.C.: 1957), pp. 34–35. (Statistical Bulletin No. 210.)
Note: Original data were given for individual years 1954, 1955, and 1956 which were then averaged to form this table. Production for fresh market was quoted in sources in terms of 1,000 hundredweight which were converted to tons for this table.

desert valleys—tends to be more specialized in the production of tomatoes for fresh market, while the bulk of the processing crop is grown north of the Tehachapi Range.

Many varieties of tomatoes are grown in California, differing with respect to their final uses, disease resistance, and reaction to climatic conditions. Earliana types are often used in the southern desert regions to obtain an early crop for fresh market. Pritchard and Pennheart varieties are grown for much the same purpose in the southern San Joaquin Valley. The most important variety, however, is the Improved Pearson, which is the choice of the overwhelming majority of California growers. It sets fruit over a wide range of temperatures and is adaptable to both processing and fresh market use. The Improved Pearson is by far the most popular of the round-type canning tomatoes. Among the pear-shaped tomatoes used for processing the San Marzano is the chief variety; it is commonly used for tomato paste because it gives a product of thick consistency.

Production of tomatoes for processing

The canning industry of California utilizes the major share of the state's tomatoes. In 1954–1956, 88 per cent of the crop was sold to processors. California tomato growers tend to be specialists in either the processing or the fresh market. As a result, there is little exchange between the two markets. Most of what little interchange there is tends to be in the direction of sending tomatoes originally intended for the fresh market to the canneries. (See Page 48.) In contrast, Virginia and Texas are states where the fresh market is sharply competitive with the processing outlet. In Virginia, virtually all tomato acreage is dual purpose, and the greater part of the Texas processors' supply comes from acreage grown for and largely used in the fresh market.[22]

California's growing importance. California's current importance in the national picture is shown by the fact that it produces more tomatoes for processing than all other states combined (Table 14). Average annual production in California for the years 1954–1956 was 2,030,767 tons grown on about 115,000 acres. This represents an average yield of 17.6 tons per acre. California enjoys a decided advantage as the yield of canning tomatoes in all other states averages only 7.5 tons per acre. The state has always shown a higher yield than the rest of the nation, and it has improved its standing through the years. Thirty years ago California's yield averaged 6.1 tons per acre compared with 4.2 tons in other areas—a yield advantage of 1.9 tons. Since that time, the state's edge over other producing regions has climbed to 10.1 tons per acre.

Acreage and production of canning tomatoes in the United States have increased during the past three decades chiefly owing to the enormous growth which has taken place in California. The state's production has increased more than 30 times as fast as that of all other areas. Acreage has almost quadrupled in California, while it has decreased by more than 25 per cent in other producing states. Consequently, California's share of the national production of canning tomatoes has increased from about 13.4 per cent to 57.8 per cent during the past 30 years.

Geographic shifts in canning tomato acreage within California. The main centers of production of California canning tomatoes have shifted to the north and east, and production has become more highly concentrated in the chief producing areas. At the end of the 1920's, the area around San Francisco Bay was the center of canning tomato

[22] This information was supplied by Mr. V. C. Childs, Federal Agricultural Statistician for Texas, and Mr. T. L. Stuart, Federal Agricultural Statistician for Virginia.

Table 14. Acreage, Production, and Yield of Canning Tomatoes, United States, California, and Other States, Three-Year Annual Averages, 1924–1926 to 1954–1956

Year	Acreage				Production				Yield		
	United States	California	Other states	California as percentage of United States	United States	California	Other states	California as percentage of United States	United States	California	Other states
	acres			per cent	tons			per cent	tons per acre		
1924–1926	303,233	29,417	273,816	9.7	1,332,667	178,200	1,154,467	13.4	4.4	6.1	4.2
1929–1931	342,597	40,677	301,920	11.9	1,422,867	219,333	1,203,534	15.4	4.2	5.4	4.0
1934–1936	419,820	68,817	351,003	16.4	1,704,467	350,600	1,353,867	20.6	4.1	5.1	3.9
1939–1941	407,560	73,033	334,527	17.9	2,331,567	544,800	1,786,767	23.4	5.7	7.5	5.3
1944–1946	532,470	129,233	403,237	24.3	2,943,823	1,063,533	1,880,290	36.1	5.5	8.2	4.7
1949–1951	359,993	99,733	260,260	27.7	3,118,370	1,390,533	1,727,837	44.6	8.7	13.9	6.6
1954–1956	313,510	115,267	198,243	36.8	3,516,127	2,030,767	1,485,360	57.8	11.2	17.6	7.5
	per cent										
Per cent change: 1924–1926 to 1954–1956	+3.4	+291.8	−27.6		+163.8	+1,039.6	+28.7		+154.5	+188.5	+78.6

Sources:
1924–1926 to 1944–1946: U. S. Bureau of Agricultural Economics, "Vegetables for Commercial Processing, Revised Estimates, 1918–50, by States" (Washington, D.C.: 1953), pp. 101–105. (Statistical Bulletin No. 132.)
1949–1951 and 1954–1955: U. S. Agricultural Marketing Service, "Vegetables for Processing, Acreage, Production, and Value, by States, 1949–55, Revised Estimates" (Washington, D.C.: 1957), pp. 34–35. (Statistical Bulletin No. 210.)
1956: U. S. Agricultural Marketing Service, "Vegetables—Processing; 1956 Annual Summary" (Washington, D.C.: 1957), p. 16. Processed.
Note: Original data were given for individual years which were then averaged to form this table.

production (Table 15). These central coast counties contained more than 40 per cent of the state's acreage (Table 16). This was the period when the region around Oakland and San Jose was especially important, as Santa Clara, Alameda, and Contra Costa were the state's three leading counties in canning tomato production. During the 1930's, the southern part of the state maintained its level of relative importance at something approximating one-sixth of the state's acreage. But in central California some trends were already noticeable. Santa Clara and Contra Costa lost ground while counties farther inland and to the north gained in importance, notably San Joaquin and Sacramento.

Between 1940 and 1945, the impact of World War II contributed to almost doubling California's canning tomato acreage; and in this upward spurt, the northern and interior valley counties continued to increase in importance. Whereas in 1930 the Sacramento Valley and Delta areas combined did not contain as much acreage as the central coast region, by the war's end each of these areas had surpassed the central coast in canning tomato production.

In the readjustment following the war, the state's acreage declined, although not to its prewar level. Producing areas in the southern part of the state and along the central coast dwindled into insignificance as the central valley counties took the lead in canning tomato production. At the present time, the Delta region supplies almost 40 per cent of the state's acreage, and 83 per cent of that is located in a single county—San Joaquin. The three main producing counties are now San Joaquin, Yolo, and Sacramento, producing among them about three-fifths of the state's acreage of canning tomatoes. This represents a much higher concentration of acreage than in 1929–1931 when the three leading counties contributed only one half of the total. Concentration of production is slightly more pronounced than these figures would indicate because these areas also have high yields.

Characteristics of the growing enterprise

The canning tomato growing enterprise in California not only has grown and shifted its center of production, it also has become a more "commercial" operation. This is reflected in the size of operations of the average grower, the complexity of techniques employed in tomato growing, and a tendency of the growers to rely heavily upon processing tomatoes as a cash crop.

Number of growers and size of enterprise. California growers tend to have much more substantial tomato operations than their counterparts in other sections of the country. In 1954 there were 2,896 California farmers growing tomatoes (for all uses) on 92,715 acres—an average of 32.0 acres of tomatoes per grower.[23] This is in sharp contrast with other important producing states where the typical size of tomato plantings is less than 10 acres. Average acreage per grower has been increasing rapidly during recent years in all areas. In California it rose by almost 10 acres between 1949 and 1954.

In the twelve-county area of this study, the average size of tomato operations is considerably larger than in the state as a whole; it was 42.5 acres in 1949 and 54.5 acres in 1954. Within this area, the larger enterprises are found in the interior valley region where production has been expanding at the faster rate. In the valley area, the average tomato acreage per grower was 64.8 in 1954, while it was only 23.8 in the coastal region.[24] These

[23] U.S. Bureau of the Census, *1954 Census of Agriculture* (Washington: Govt. Print. Off., 1956), vol. 1, Counties and State Economic Areas, Part 33, California; State Table 16, p. 34.

[24] The seven valley counties are: Yuba, Sutter, Solano, Yolo, Sacramento, San Joaquin, and Stanislaus. The five coastal counties are: Napa, Alameda, Santa Clara, San Benito, and Monterey.

Table 15. Acreage of California Tomatoes for Processing, by County, Three-Year Annual Averages, 1929–1931 to 1954–1956

County	Years					
	1929–1931	1934–1936	1939–1941	1944–1946	1949–1951	1954–1956
The State	40,681	68,820	73,036	129,144	99,754	115,767
Desert	1,525	2,055	310	1,332	1,230	2,248
Imperial		787	7	39	1,074	1,540
Riverside	1,525	1,268	303	1,293	156	708
South Coast	5,469	10,268	10,159	9,466	7,123	7,608
Los Angeles	2,600	4,691	3,709	2,503	1,465	390
Orange	1,645	2,383	1,637	2,189	2,138	2,577
San Bernardino	536	962	1,904	1,246	220	44*
San Diego	41	205	393	358	781	345
San Luis Obispo		137	51		29	5*
Santa Barbara		44	836	1,565	600	102*
Ventura	647	1,846	1,629	1,605	1,890	4,145
Central Coast	17,212	20,520	20,853	31,129	11,009	11,320
Alameda	6,012	6,332	10,573	13,113	4,251	3,785
Mendocino		43				
Monterey	651	1,305	292	3,504	3,144	2,372
Napa	114	679	888	2,061	689	565
San Benito	1,776	4,137	3,618	4,293	618	1,718
San Mateo	23	25	18	77	3	
Santa Clara	8,231	7,467	5,351	7,402	2,231	2,852
Santa Cruz	160	334	68	124	36	20*
Sonoma	245	198	45	555	37	8*
San Joaquin Valley	2,057	4,827	2,225	7,542	8,035	10,008
Fresno		124		445	103	700
Inyo						
Kern			16	34	105	22*
Kings				33	7	
Madera		64		839	1	138*
Merced	396	2,028	763	2,561	1,325	2,693
Stanislaus	1,661	2,505	1,213	3,145	6,409	6,372
Tulare		106	233	485	85	83*
Delta	9,383	19,582	22,490	40,167	38,906	45,956
Contra Costa	5,888	6,217	3,390	4,038	2,062	1,833
San Joaquin	3,187	12,398	17,624	33,287	33,457	38,210
Solano	308	967	1,476	2,842	3,387	5,913
Sacramento Valley	5,035	11,568	16,999	39,508	33,451	38,627
Amador				5	14	
Butte			87	249	467	465
Colusa				350	381	252
Glenn				47		
Sacramento	3,527	6,738	9,377	14,772	11,263	10,725
Placer		50	5	107	22	
Sutter		665	371	1,330	5,058	5,507
Tehama					62	
Yolo	1,508	4,062	7,153	22,366	15,131	20,640
Yuba		53	6	282	1,053	1,038

(Footnotes on following page)

figures include acreage for fresh market as well as for processing.

No published data exist on the number of growers or the size of enterprise for canning tomatoes alone. But the large sample used in this study provided information on 746 such growers with 67,980 acres of canning tomatoes in 1956 (53.1 per cent of the actual acreage in the twelve-county area)—an average of 91.1 acres per grower. This is much larger than the 54.5 acres quoted above for growers of all types of tomatoes. In spite of the limitations of the data from this large sample, as indicated on page 8, the conclusion seems reasonable that northern California canning tomato growers operate substantially larger holdings than growers of tomatoes for fresh market. Most of the former are located in the interior regions, such as the Sacramento and San Joaquin valleys where large irrigated commercial operations are typical. This was confirmed by evidence from the large sample which indicated that growers in the valley areas had twice as much acreage planted to canning tomatoes as those in coastal regions. Average holdings per grower were 100.5 and 50.8 acres, respectively, in the two areas.

Table 16. Per Cent Distribution of Acreage of California Tomatoes for Processing by Region, Three-Year Annual Averages, 1929–1931 to 1954–1956

Region	Years					
	1929–1931	1934–1936	1939–1941	1944–1946	1949–1951	1954–1956
	per cent					
The State	100.0	100.0	100.0	100.0	100.0	100.0
Desert	3.7	3.0	0.4	1.0	1.2	1.9
South Coast	13.4	14.9	13.9	7.3	7.2	6.6
Central Coast	42.3	29.8	28.6	24.1	11.0	9.8
San Joaquin Valley	5.1	7.0	3.0	5.9	8.1	8.6
Delta	23.1	28.5	30.8	31.1	39.0	39.7
Sacramento Valley	12.4	16.8	23.3	30.6	33.5	33.4

Source: Table 15.

* Estimated by authors.

Sources:

1929–1931: Federal–State Crop Reporting Service, "California Acreage of Specified Commercial Vegetable Crops by Counties, 1929–1933" (Sacramento: 1934), 12 p. Processed.

1934–1936: California Cooperative Crop Reporting Service, "Commercial Vegetable Crops, California, Acreage by Counties, 1934–1938" (Sacramento: 1939), p. 21. Processed.

1939–1941: California Crop and Livestock Reporting Service, "Vegetable Crops in California, Commercial Acreage by Counties, 1939–1944" (Sacramento: 1945), p. 29. Processed.

1944–1946: California Crop and Livestock Reporting Service, "Vegetable Crops in California, Total Acreage, Production and Value of Commercial Crops, 1939–1948, Commercial Acreage by Counties, 1943–1948" (Sacramento: 1949), p. 29. Processed.

1949–1950: California Crop and Livestock Reporting Service, "Vegetable Crops in California, Total Acreage, Production and Value of Commercial Crops, 1941–1950, Commercial Acreage by Counties, 1945–1950" (Sacramento: 1951), p. 30. Processed.

1951: California Crop and Livestock Reporting Service, "Vegetable Crops in California, Total Acreage, Production and Value of Commercial Crops, 1918–1952, Commercial Acreage by Counties, 1951–52" (Sacramento: 1953), p. 78. Processed.

1954: California Crop and Livestock Reporting Service, "Vegetable Crops in California, Total Acreage, Production and Value of Commercial Crops and Acreage by Counties, 1952–1954" (Sacramento: 1955), p. 14. Processed.

1955: California Crop and Livestock Reporting Service, "Estimated Harvested Acreage of California Vegetables by Counties, 1955," p. 6. Processed.

1956: California Crop and Livestock Reporting Service, "California Tomatoes for Processing, Acres Harvested and Tons Produced by Counties as Reported by Processors, 1956 Crop, March, 1957." Single sheet release. Processed.

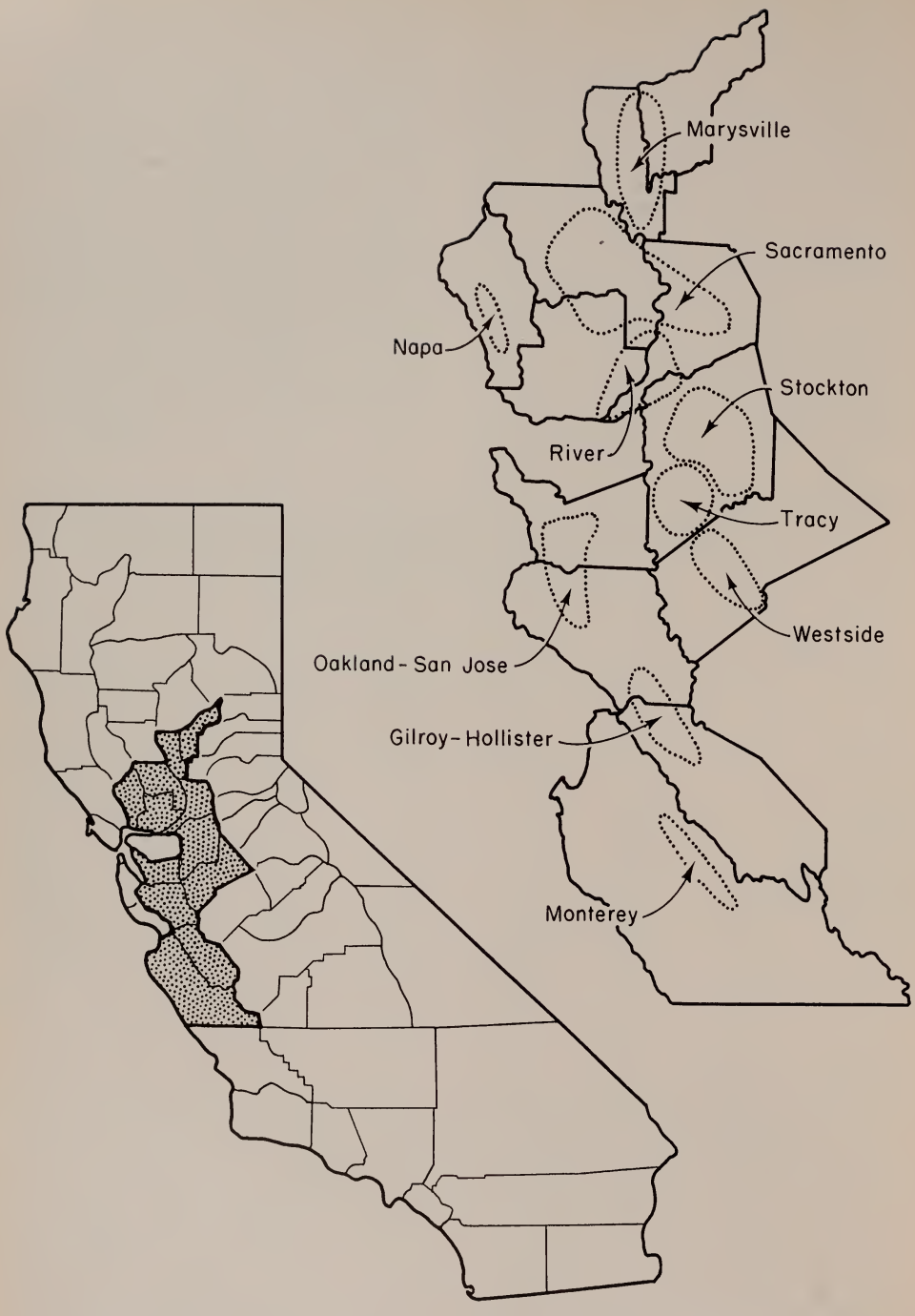

Fig. 5. Twelve-county major producing region of northern California: ten production areas.

Other grower characteristics. Growers do not typically own the land on which they produce canning tomatoes; leasing is widely prevalent in California. Few data are published on the extent of leasing practices, but almost 75 per cent of the small sample of 116 growers in Yolo and San Joaquin counties were growing their 1956 crop of canning tomatoes on rented land exclusively. A great variety of rental terms was employed. Most commonly, shares of the crop were paid to the landlord, who frequently supplied water and shared certain costs as for fertilizer and dusting. The typical duration of a lease was one year, although about 10 per cent of them were in effect for five years or more, and another 10 per cent were obtained from relatives on a long-term but indefinite basis.

California growers are specialists in the production of canning tomatoes, both in the sense that they are experts in the technique of growing the crop, and that a majority of them grow canning tomatoes every year. They are not, however, one-crop growers; to designate them as specialists in that sense would be misleading. Only 10 of the 116 growers interviewed in Yolo and San Joaquin counties grew tomatoes exclusively. Most growers produced two, three, or four crops including tomatoes. A great many different crops were raised by these growers; actually, 51 were mentioned. However, only three were grown by as many as one-third of the growers; these were sugar beets, alfalfa, and barley. A typical rotation for tomato growers is tomatoes, sugar beets, barley, and alfalfa, and it seems likely that most of the sample growers were dividing their holdings among two or more of these crops to keep their rotation in effect.

Because county boundaries are of little significance in delimiting tomato-growing regions, the 12 counties included in the study were reclassified into production areas. In many instances, portions of several counties were combined to form one homogeneous area. The names, descriptions, and estimates of the relative importance of each of these production areas were provided by the Farm Advisors in each of the 12 counties. The 10 production areas thus formed were modeled as closely as possible on the districts shown in the publication of the California State Department of Agriculture, Bureau of Fruit and Vegetable Standardization, *Canning Tomato Inspection, Report of Defects, 1952, 1953, 1954.* These districts were defined not so much on the basis of geographical considerations as on the similarity of canning tomato fruit characteristics. In this study, it was convenient to select the production areas to correspond to these districts because the report cited above includes data on the canning tomato tonnage harvested in each district by 10-day periods throughout the season. Appendix B contains a brief description of each production area together with the inspection points of the corresponding Bureau of Fruit and Vegetable Standardization district.[25] The geographical location of each production area is pictured in Figure 5 .

Table 17 shows the actual acreage and the corresponding large-sample figure for each of these production areas in 1956. The actual acreages shown for regions within counties are not available in any official state publication but are estimates made for this study. They are based on information received from the Farm Advisors, adjusted to add to the actual county acreages published by the

[25] In two instances, the state inspection district encompasses two production areas. Appendix B contains detailed maps which will allow the reader to compare more carefully each production area with the corresponding set of inspection points comprising a state district. Included on the maps also is information on the location of the acreage of the large-sample growers.

Table 17. Actual and Sample Acreage of Tomatoes for Processing, Ten Production Areas (Twelve Counties) of Northern California, 1956

Production area, county and region	Actual acreage	Per cent distribution of actual acreage		Sample acreage	Sample acreage as percentage of actual
		To state	To ten areas		
	acres	per cent		acres	per cent
The State	151,500	100.0		67,980	44.9
Ten production areas	128,000	84.5	100.0	67,980	53.1
Area 1: Marysville	8,670	5.7	6.8	4,749	54.8
Sutter County, total	7,260	4.8	5.7	4,111	56.6
Yuba County, total	1,410	0.9	1.1	638	45.2
North of Marysville	940	0.6	0.7	638	67.9
South of Marysville	470	0.3	0.4	.....	....
Areas 2 and 3	29,752	19.7	23.2	16,959	57.0
Area 2: Napa	720	0.5	0.5	389	54.0
Napa County, total	720	0.5	0.5	389	54.0
Area 3: Sacramento	29,032	19.2	22.7	16,570	57.1
Yolo County	20,360	13.5	15.9	11,912	58.5
Woodland	10,716	7.1	8.4	7,940	74.1
Esparto	4,286	2.8	3.3	1,392	32.5
Davis–Winters	5,358	3.6	4.2	2,580	48.2
Sacramento County	3,648	2.4	2.9	2,322	63.7
Elk Grove	1,581	1.0	1.2	855	54.1
Natomas	1,459	1.0	1.2	987	67.6
Pocket	608	0.4	0.5	480	78.9
Solano County	5,024	3.3	3.9	2,336	46.5
Dixon	5,024	3.3	3.9	2,336	46.5
Area 4: River	20,338	13.4	15.9	13,110	64.5
Yolo County	6,430	4.2	5.0	4,593	71.4
Clarksburg	6,430	4.2	5.0	4,593	71.4
Sacramento County	8,512	5.6	6.7	5,336	62.7
River	8,512	5.6	6.7	5,336	62.7
Solano County	2,706	1.8	2.1	1,019	37.7
Rio Vista	2,706	1.8	2.1	1,019	37.7
San Joaquin County	2,690	1.8	2.1	2,162	80.4
Thornton	2,690	1.8	2.1	2,162	80.4
Area 5: Stockton	21,472	14.2	16.8	10,921	50.9
San Joaquin County	21,472	14.2	16.8	10,921	50.9
Linden	9,450	6.2	7.4	2,068	21.9
Roberts Island	4,212	2.8	3.3	3,156	74.9
Lodi	3,610	2.4	2.8	3,122	86.5
Stockton–Manteca	4,200	2.8	3.3	2,575	61.3

(Continued on next page.)

Table 17—(Continued)

Production area, county and region	Actual acreage	Per cent distribution of actual acreage		Sample acreage	Sample acreage as percentage of actual
		To state	To ten areas		
	acres	per cent		acres	per cent
Area 6: Tracy	24,138	15.9	18.9	10,711	44.4
San Joaquin County	24,138	15.9	18.9	10,711	44.4
Tracy	21,000	13.8	16.4	8,912	42.4
Union Island	3,138	2.1	2.5	1,799	57.3
Area 7: Westside	10,180	6.7	7.9	4,759	46.7
Stanislaus County, total	10,180	6.7	7.9	4,759	46.7
Areas 8 and 9	10,330	6.8	8.1	4,126	39.9
Area 8: Oakland–San Jose	5,362	3.5	4.2	1,549	28.9
Alameda County, total	3,530	2.3	2.8	1,132	32.1
Centerville	2,017	1.3	1.6	527	26.1
Pleasanton	807	0.6	0.6	397	49.2
Mt. Eden	504	0.3	0.4	140	27.8
Warm Springs	202	0.1	0.2	68	33.7
Santa Clara County	1,832	1.2	1.4	417	22.8
San Jose	1,628	1.1	1.3	417	25.6
Morgan Hill	204	0.1	0.1	.....	....
Area 9: Gilroy–Hollister	4,968	3.3	3.9	2,577	51.9
Santa Clara County	2,238	1.5	1.8	681	30.4
Gilroy	2,238	1.5	1.8	681	30.4
San Benito County, total	2,730	1.8	2.1	1,896	69.5
Bolsa	1,366	1.0	1.1	1,119	81.9
San Juan Bautista	682	0.4	0.5	355	52.1
Paicines	682	0.4	0.5	422	61.9
Area 10: Monterey	3,120	2.1	2.4	2,645	84.8
Monterey County, total	3,120	2.1	2.4	2,645	84.8

Sources:
Actual acreage: Data for regions within counties are estimates made for this study, not official state statistics. They are based on information received from the Farm Advisors in the twelve counties (see p. 9), adjusted to add to actual county total acreages in 1956, as shown in: California Crop and Livestock Reporting Service, "California Tomatoes for Processing, Acres Harvested and Tons Produced by Counties as Reported by Processors, 1956 Crop, March, 1957." Single sheet release. Processed.
Sample acreage: All data are from large sample of growers (see pp. 8-9 for description of this sample).

California Department of Agriculture. Table 18 shows the 1952–1954 annual average tonnage of canning tomatoes produced in each of the production areas (in two cases, combinations of two production areas).

Seasonality of production. Four of the production areas—Sacramento, River, Stockton, and Tracy—together account for about three-fourths of the canning tomato acreage and production in all areas combined. Included in these areas are the state's three most important producing counties: San Joaquin, Yolo, and Sacramento. Of the major producing districts, the combined Napa-Sacramento district is by far the leader with almost 25 per cent of the production. Unlike

Table 18. Production of California Tomatoes for Processing, Round and Pear-Shaped Types Combined, Ten Production Areas of Northern California, Annual Average of 1952–1954

Production areas	Production of tomatoes for processing	Production as percentage of	
		State total	Ten-area total
	tons	per cent	
The State	1,569,550	100.0	
Ten-area total	1,441,785	91.9	100.0
1. Marysville	102,679	6.6	7.1
2 and 3. Napa–Sacramento	356,969	22.8	24.8
4. River	256,266	16.3	17.8
5. Stockton	223,805	14.3	15.5
6. Tracy	210,616	13.4	14.6
7. Westside	130,473	8.3	9.0
8 and 9. Oakland–San Jose and Gilroy–Hollister	115,033	7.3	8.0
10. Monterey	45,944	2.9	3.2

Source: California Department of Agriculture, Bureau of Fruit and Vegetable Standardization, "Canning Tomato Inspection Report of Defects, 1952, 1953, 1954." In this report, data were shown separately for each of the three years. They were averaged to obtain data shown in this table. Data for the state inspection districts are attributed to the corresponding production areas or combinations of production areas.

some other areas, its rank does not alter much during the season. It produces more tonnage than any of the other areas in every 10-day production period from August 1 on past November 1 which usually marks the close of the canning season (Table 19). Its production forms a larger share of the total early in the season during August when half or more of the available supply comes from this production area. In late September and October, its contribution drops to about one-fifth. This merely reflects the fact that few areas produce many tomatoes early in the season while, at the peak, production is more widely diffused over many areas.

Harvesting of canning tomatoes in all areas combined is very highly concentrated within a brief time span (Fig. 6). The season lasts about three months, and 75 per cent of the tonnage is delivered within a single month—from mid-September to mid-October. Each area's harvest is also rather concentrated, but there

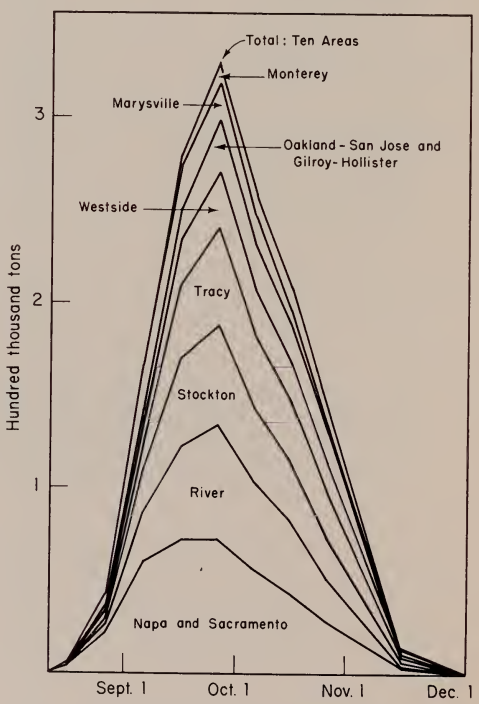

Fig. 6. Seasonal pattern of the total canning tomato production in ten areas of northern California, average of 1952–1954.

Table 19. Production of California Tomatoes for Processing, Round and Pear-Shaped Types Combined, by Ten-Day Periods, Ten Production Areas of Northern California, Annual Average of 1952–1954

Period	Total	1	2 and 3	4	5	6	7	8 and 9	10
	Ten areas	Marysville	Napa–Sacramento	River	Stockton	Tracy	Westside	Oakland–San Jose and Gilroy–Hollister	Monterey
	tons								
Total	1,441,785	102,679	356,969	256,266	223,805	210,616	130,473	115,033	45,944
August 1–10	54		54						
August 11–20	5,631	1,393	2,686	401	164	515	403	69	
August 21–31	41,805	6,534	21,102	5,203	2,700	3,819	1,799	355	293
September 1–10	166,416	23,527	59,931	26,768	23,585	16,252	11,697	3,798	858
September 11–20	278,517	22,284	71,781	50,433	47,917	40,390	24,129	16,772	4,811
September 21–30	328,912	18,762	71,962	62,555	53,668	52,067	30,621	28,303	10,974
October 1–10	257,871	14,556	55,953	46,927	40,455	39,650	22,805	25,558	11,967
October 11–20	206,591	9,464	42,755	39,087	31,719	32,777	19,693	20,878	10,218
October 21–31	141,769	5,584	28,050	23,382	21,273	22,882	16,817	17,337	6,444
November 1 and later	14,219	575	2,695	1,510	2,324	2,264	2,509	1,963	379

Source: Same as Table 18.

Table 20. Per Cent Distribution of Canning Tomato Production, by Ten-Day Periods, Ten Areas of Northern California, Annual Average of 1952–1954

Period	Total	1	2 and 3	4	5	6	7	8 and 9	10
	Ten areas	Marysville	Napa–Sacramento	River	Stockton	Tracy	Westside	Oakland–San Jose and Gilroy–Hollister	Monterey
	per cent								
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
August 1–10	*		*						
August 11–20	0.4	1.3	0.7	0.2	0.1	0.2	0.3	0.1	
August 21–31	2.9	6.4	5.9	2.0	1.2	1.8	1.4	0.3	0.6
September 1–10	11.6	22.9†	16.8	10.4	10.5	7.7	8.9	3.3	1.9
September 11–20	19.3†	21.7†	20.1†	19.7†	21.4†	19.2†	18.5†	14.6	10.5
September 21–30	22.8†	18.3	20.2†	24.4†	24.0†	24.7†	23.5†	24.6†	23.9†
October 1–10	17.9	14.2	15.7	18.3	18.1	18.8†	17.5†	22.2†	26.1†
October 11–20	14.3	9.2	12.0	15.3	14.2	15.6	15.1	18.1	22.2†
October 21–31	9.8	5.4	7.9	9.1	9.5	10.9	12.9	15.1	14.0
November 1 and later	1.0	0.6	0.7	0.6	1.0	1.1	1.9	1.7	0.8

* Less than 0.05.
† Chief producing periods
Source: Table 19.

is some variation among them with respect to its intensity. The Monterey district, for example, is very sharply peaked, marketing half its crop within the top 20 days of its season (Table 20). The Oakland-San Jose and Gilroy-Hollister areas (production areas 8 and 9 considered together) are also highly seasonal, harvesting about 47 per cent of their crop in 20 days. On the other hand, the Napa-Sacramento district shows the least concentration in deliveries. It is the only area which harvests less than 60 per cent of its total within 30 days.

Another factor affecting seasonality is the timing of production peaks in different areas. Even if all areas had identical harvesting patterns—and, as we have seen, they do not—there would still be variations in deliveries between areas. This is due to the fact that the top 20 days in one district may be earlier or later than those of another district even if both should harvest the same proportions of their crops, or the same absolute quantities, within the same number of days. As Table 20 shows, the peak production periods do not occur simultaneously in all production areas. There actually is a lag of four or five weeks between the times the earliest and latest areas reach their production peaks. The River area exhibits a fairly stable pattern similar to that of Napa-Sacramento, contributing 10 per cent or more of the total in each production period from the end of August to the season's close. But areas such as Marysville vary greatly in importance from one period to another. During August, Marysville ranks second after Napa-Sacramento, but thereafter its importance rapidly diminishes. Its total contribution is rather small, amounting to only 7 per cent over the entire season; but because of its early peak, it has a particular importance to canners who wish to begin their operations early (Fig. 7).

Other areas with definite seasonality are the Oakland-San Jose, Gilroy-Hollister, and Westside production areas which contribute more heavily toward the latter part of the season. In general, there is a progression from northern to southern areas with the northernmost coming into production early in the season and the more southerly gradually becoming more important as the season progresses. There is also some variation in maturity dates within areas. For example, the Stockton district embraces a rather wide area, with its northern part customarily maturing at least a week before the southern part.

Organization of sellers. In apposition to the Canners League on the processors' side of the market is the California Tomato Growers Association. Its membership is open to "any person, partnership, association, or corporation engaged in growing tomatoes." It has no membership fee and in 1956 covered its operating expenses with dues of five cents for each ton of tomatoes produced by the member. In that year, about half of the northern California canning tomato growers were members of C.T.G.A.

The main objective of the Association is to improve the growers' bargaining position by providing them with information on which to base their decisions—for example, market and crop prospects in California and elsewhere, harvesting progress and difficulties, and other factors that might affect the market for tomatoes. The organization also tries to secure revision of various provisions in canners' contracts. In this connection, it has designed its own contract form which it recommends for canners' use.

Among other ways in which the Association serves its members are the following: it supports legislation beneficial to growers and opposes laws unfavorable to them; it gathers information, at the request of individual growers, on the financial condition and the history of canner-grower relations of particular firms; in some cases it represents its members in their differences with canners over delivery and related problems; and it co-

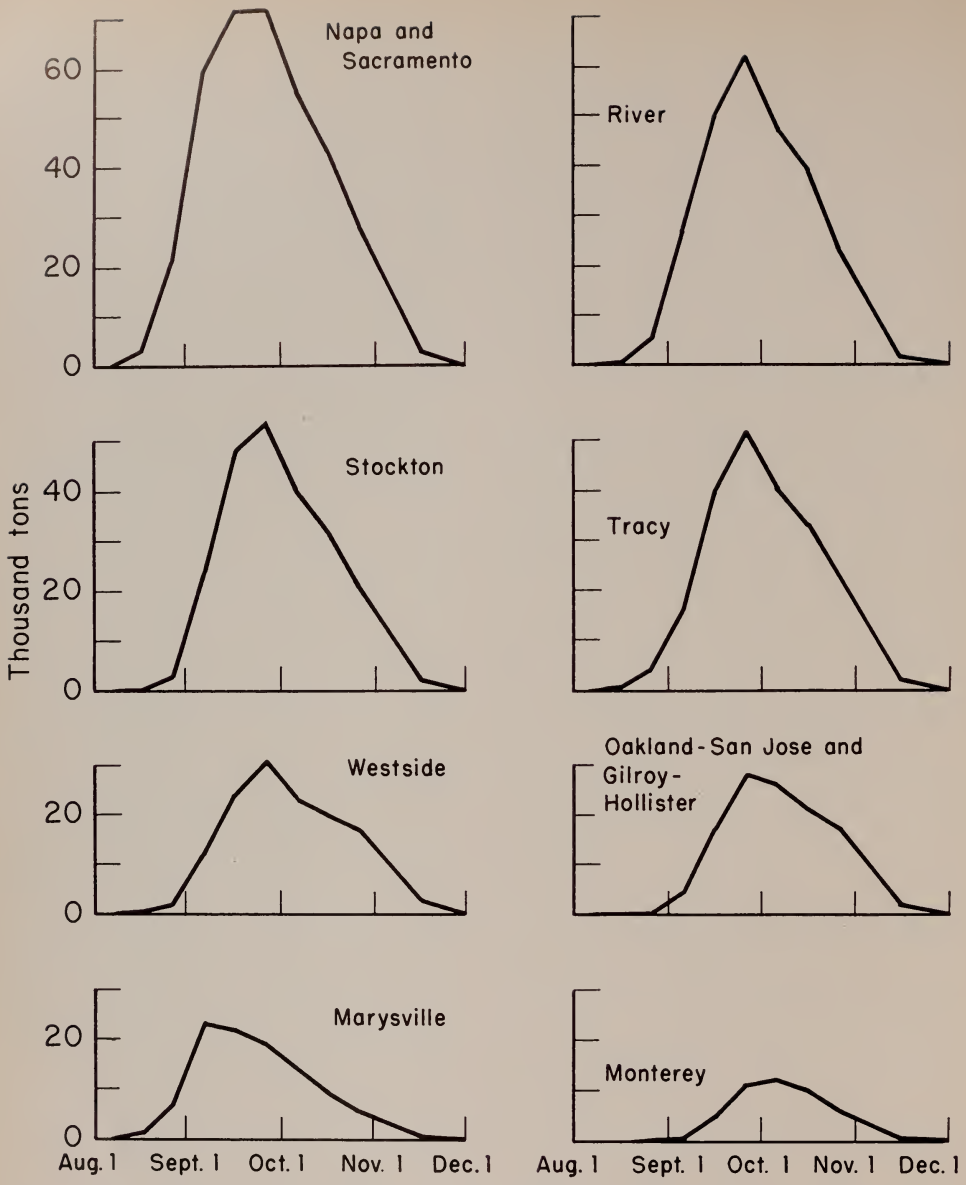

Fig. 7. Seasonal pattern of canning tomato production in each of the ten areas of northern California, average of 1952–1954.

operates with state agencies and the University of California on various types of research affecting the tomato industry.

While its main efforts have been primarily educational and informational, the Association has, on several occasions, attempted to expand its function beyond this. In the fall of 1954, it asked its members to sign marketing contracts which would bind them to sell processing tomatoes "upon such terms and conditions as [the] Association shall fix." This contract, similar to those used by other cooperative bargaining associations, would have made the Association the price bargaining agent of its members. However,

it did not become effective because an insufficient number of signatures was obtained. Even though the C.T.G.A. has not, in the past, achieved the status of official bargaining agent, it has on some occasions played an important role in affecting prices received by growers.[26] Thus, the California Tomato Growers Association is much more active in its attempts to influence the market directly than is the Canners League.

III. Grower-Processor Relationships

In Section II we have described the market structure on the buying and selling sides of the California tomato processing industry. Economists study industrial market structures in order to help isolate strategic factors affecting industrial conduct and performance. This study is primarily directed toward those aspects of market conduct which pertain to the interfirm relationships between growers and processors. Economic theory is a useful preliminary tool in examining such relationships. It instructs us as to some possible types of conduct that may be associated with different market structures. But this knowledge alone usually is not sufficient for a complete explanation of the unique way an industry operates. Specifically, in this case, the particular procurement problems of processors and the related marketing and production problems of growers must be considered to understand properly the role played by their integrated relationship.

This section discusses: (a) the technical and market conditions that lead to interdependence between tomato growers and processors; (b) the nature of the integrated relationship that has arisen in this industry and the legal basis for it; and (c) some aspects of the industry's performance, particularly with respect to pricing policy.

FACTORS AFFECTING INTERDEPENDENCE OF GROWER AND PROCESSOR INCOME POSITIONS

According to the theoretical discussion in Section I, some form of integration often develops when the income positions of growers and processors are interdependent owing to the presence of certain market and technical factors. In many industries this interdependence arises out of the interrelationships that exist among the physical input-output functions of the individual firms. The major subject that conceivably could be of such mutual interest in the tomato processing industry is the raw product supply. The economic rationale for some form of coordinated decision-making over the activities of production and processing firms lies in their dependence on one another for tomato outlets and supplies. Some procurement problems of processors and related production and marketing problems of growers may find their solution in an integrated interfirm relationship; these problems are investigated here by discussing the attributes of raw product supply which are important to the income positions of both canners and growers.

Total quantity of raw product

Processors are particularly concerned that an adequate total quantity of tomatoes is available. Sufficient inducement

[26] Since this bulletin was prepared, the Association has apparently had more success in this respect, particularly in the 1958 season.

must be presented to growers so that they plant enough acreage to supply the tomatoes needed.

The nature of the market outlets is important to the grower in making his plans. Tomatoes grown solely for processing must be sold to canneries within a limited radius. If these plants are operating at capacity, there are no other satisfactory uses for the tomatoes. On the other hand, growers of fresh-market tomatoes have available a nationwide market of many buyers and are virtually certain they can dispose of their crop at some price.

Such uncertainties about available buyers take on increased importance to the grower because his out-of-pocket production costs are substantial. Even before harvest, a producer must invest about $100 an acre for seeds or plants, transplanting, fertilizer, pest and disease control measures, weeding, irrigation, and land preparation.[27]

An additional reason why growers prefer an assured market outlet is the fact that a large percentage of the tomatoes are raised on leased land. It was estimated from the small sample data for Yolo and San Joaquin counties that more than four-fifths of the crop was so grown. Tomato leases in California usually are made on a year-to-year basis because tomatoes are customarily not grown on the same land for more than one or two consecutive years. To obtain new land every year, the producer must fit his tomato operations into the crop rotation of the prospective lessor. But the landowner, particularly if a share-rent arrangement is used, is anxious for his tenant to have an outlet for the tomato crop. Since leasing must take place well before planting time, the grower is encouraged by the lessor to obtain a cannery commitment to make sure the tomatoes will be purchased.

Such commitments are also encouraged by lending institutions advancing growers all or part of their preharvest expenses. If the producer has no assurance of a "home" for his tomatoes, most credit sources will look upon him as an extremely poor credit risk unless he has other forms of collateral.

The foregoing factors magnify the effect of uncertainties inherent in the market structure concerning whether the product may in fact be sold at all.

These same structural characteristics of the processing industry lend themselves to considerable price uncertainty on the part of the grower. In evaluating production alternatives, some estimate of the product's sale price must be made. A relatively few canners buy a large percentage of the total output. Canner procurement policies are not determined in any mechanistic sense in an open market as would be true if there were a large number of relatively small buyers openly bidding at time of harvest.

The uncertainties resulting from these various technical and market conditions make it extremely difficult to appraise the potential profitability of tomato production. In the California tomato canning industry, certain important factors are crucial to the decision-making process of growers but cannot be predicted in any systematic or meaningful way without some explicit arrangement with processors. Producers, therefore, find strong encouragement for some form of grower-processor relationship which will effectively resolve some of their uncertainties and which will help them decide whether or not to grow tomatoes.

Canners also may welcome such relationships with growers as they, too, are confronted with important uncertainties. If there were a large open market for tomatoes at time of harvest, the processor might be expected to bid for the tonnage

[27] For one estimate of such costs, see MacGillivray, John H., A. E. Michelbacher, and C. Emlen Scott, *Tomato Production in California* (Berkeley: 1950), p. 15. (Table 5.) (California Agricultural Extension Service Circ. 167.)

desired at that time. The hope would be that growers would operate in such a manner that the total supply forthcoming would fit the processing requirements. The competitive structure of the canning industry effectively precludes such procurement methods on the part of at least the major canners. If a processing firm were relatively small compared with the total canning industry, its individual purchases would have no effect on total demand, and it could always hope to satisfy tonnage requirements at some price. But the California canning industry does not have such characteristics. In every producing area, four canners purchase over 40 per cent of the total acreage, and eight canners purchase more than 65 per cent (Fig. 4). Consequently, the demands of certain canners do constitute an appreciable portion of the total demand. These purchasers cannot expect, therefore, that their procurement actions will not affect actions taken by other canners. Since the large canners cannot expect that an adequate supply will be available at all times in the open market, there is a strong incentive for them to take special action to insure that they obtain the desired quantity of raw tomatoes. One method of accomplishing this is to make direct dealings with growers to insure that their tonnage will be delivered to a particular cannery.

Once it becomes advantageous for the large canneries to make preharvest commitments with growers, the chances are very much lessened that the smaller canners will find sufficient uncommitted tontage available at harvest time. The open market supply (tomatoes not committed to a particular buyer) is reduced. Also, growers with production, leasing, and credit problems are likely to make concessions to canners in order to obtain a preharvest—or possibly a preplanting—purchase commitment. Canners who are not parties to such arrangements will find the available unsold tonnage at harvest reduced even further. Thus, the fact that the large processors are induced to enter into some form of grower-processor relationship lends strong encouragement for similar actions to be taken by *all* canners.

Location of supply

Location of supply is also of economic importance to canners. Processor profit is affected by hauling expense, over-all yield stability, and timing of maturity dates which vary with acreage allocations among the different production areas.

Although other factors affect the firm's choice among alternative locational patterns of tomato acreage, the effect on total hauling expense is an important consideration. Other things being equal, canners—particularly those in deficit producing regions—are interested in inducing greater production close to their plants. The incentive to reduce uncertainties as to the total quantity available through some form of integrated relationship with growers, as discussed above, is reinforced by this further desire to control its location as well.

The canner's interest in yield stability also prompts his concern for the locational distribution of acreage. One of his problems is to convert estimated raw product needs into the acreage which growers should be encouraged to plant. The possibility of abnormal weather, pest, or disease conditions makes it difficult to predict the actual relationship between acreage and tonnage harvested. These causes of yield variation almost always affect yields more in one area than in others. Yields in particular production areas vary more on the average from year to year than does the average yield for all areas combined. This can be appreciated by examining recent data. The average yield per acre in the twelve-county area was 10 per cent higher in 1956 than in 1955. But the variation in certain counties was much greater: Yuba, +29.3 per cent; Napa, −29.2 per cent; Monterey, +29.8 per cent; Alameda, +25.9 per cent; and Yolo, +16.6 per

cent.[28] Thus, by not purchasing all of his tomato requirements in a particular producing area, a processor can more closely predict the final acreage-tonnage ratio. This provides another incentive for a direct relationship with tomato growers in order to affect the production decisions on location of acreage planted.

The third factor encouraging canners to affect these production decisions is related to the customary maturity and harvesting dates characteristic of each major producing area. Tomatoes do not mature evenly or uniformly throughout the harvest season. Tomato processors, dealing with a perishable product, must pack the entire crop shortly after harvesting. The fact that in each of the production areas a large percentage of the crop matures within a very short time creates some serious technical problems for the processor. Canners cannot completely overcome these problems but can minimize their effects by (1) varying plant operations to meet supply variations, or (2) modifying or controlling the maturity dates and hence the time of delivery. California canners do both.

Most tomato processing plants are quite flexible regarding the quantity of tomatoes they can handle efficiently during a given time. This flexibility is attained in several ways. A number of processing lines may be available. And since the seasonal labor supply is fairly flexible, the number of lines in operation at any time can be varied. When all lines are operating, additional output can be obtained by employing two shifts. Often during the peak of the tomato harvest, California tomato canners operate all of their lines for two 10-hour shifts or even three 8-hour shifts. Also, the speed of processing a given tonnage can be varied depending upon which final product is being produced. Tomatoes can be processed more rapidly into tomato paste, for example, than into canned whole peeled tomatoes.

But once capacity operation is reached, adjustments must be made in the delivery rates of the raw product. Canners have an incentive to reduce per unit production costs by operating their plants near capacity for as long a period as possible. This permits spreading overhead costs over a greater volume of output. One important way to accomplish this is to pack other products before and after the tomato season. Most California tomato canners have such multiple-purpose plants.

Canneries can easily become glutted during the top two or three weeks of the harvest season. It is not uncommon for 40 to 45 per cent of the total tonnage to be delivered within a 3-week period (Table 20). The data show, however, that these periods of concentration vary somewhat among the various production areas. The Marysville production area is the first to reach its seasonal peak, and the Monterey, Oakland-San Jose, and Gilroy-Hollister areas are the last. If a canner relied upon the tomatoes from only one production area—say, the nearest one—he would be subject to an extremely variable supply over the harvest season. In order to take advantage of whatever differences there are among production areas in the timing of harvest, a canner must acquire tonnage grown in a number of areas. Again, the processor is interested in affecting the location of tomato supplies. This provides further incentive for him to enter into an explicit relationship with growers so that the tonnage obtained may be spread in an optimum manner over the various producing regions.

The importance of this voluntary dispersion of acreage practiced by northern California canners is evidenced by the

[28] California Crop and Livestock Reporting Service. Calculations based on contracted round-type tomatoes only.

fact that only eight of the 29 firms interviewed made no effort to practice it. These firms were smaller than average and had much lower than average distances from field to plant. These tend to be the same plants for which hauling costs are of paramount importance. Four of these firms even expressed some interest in extending their operating season but were able to accomplish it sufficiently well for their purposes within a small area. These firms with small acreage requirements are able to give their growers very close supervision and to exert tight control over grower practices because of the limited area in which they buy.

The remaining 21 firms planned their purchases with dispersion clearly in mind. The chief reason for this was their desire to extend the operating season and to level peak deliveries by taking advantage of seasonal differences between production areas. Nineteen of the 21 firms which dispersed their purchases mentioned this as a reason for doing so. About a third of these considered it the main factor in their purchasing plans. They were among the largest firms in the industry in terms of tomato acreage contracted. Nine firms practiced dispersion in order to obtain a specific quality of tomato or, equally important, a "good grower." Five companies used dispersion of their purchases as an insurance measure against catastrophe following the principle of diversification. Naturally, many firms were concerned with more than one of these advantages. The opinions expressed by the cannery officials interviewed on this subject were borne out by the sample data. Firms which did not practice dispersion contracted in very few areas, usually only one or two and in no case more than three. On the other hand, companies actively interested in affecting the location of their supplies always contracted in at least three different production areas, and six of them were active in more than five areas. The average number of areas in which these dispersing firms purchased was five.

Right kind of product

A third area of concern to canners—in addition to quantity and location—is the physical characteristics of the raw product. Two attributes are important: variety and quality.

Variety. California processing tomatoes are of two general types: round and pear shapes. Round tomatoes are all-purpose canning tomatoes and have comprised approximately 95 per cent of the crop in recent years. Pear tomatoes are used primarily in the manufacture of paste because they give a product of thicker consistency. The Improved Pearson is the predominant round variety grown in northern California; the San Marzano is the principal pear-shaped variety. Because there are differences in the canning qualities of these two general types of tomatoes as well as in the different varieties within each type, processors are interested in sharing the production decisions concerning the acreage allocation among them.

Some firms engage in extensive variety development programs. Certain processors feel that the varieties and strains of canning tomatoes used are of critical importance in assuring a uniform product. If consumers, for example, have developed a preference for a soup of particular taste attributes, canners do not want these characteristics to change from season to season because of varying mixtures of raw product varieties used. Since tomatoes are customarily obtained from a large number of growers, uniformity of the offerings can perhaps best be obtained by the canner who can affect the corresponding production decisions of all his suppliers. In other words, vertical integration of the activities of growers and of a marketing firm is probably an effective device to achieve the desired de-

gree of horizontal coordination at the producer level.[20]

Quality. Vegetable processing today is a mass-production operation, and some physical characteristics of the product are crucial to the speed and effectiveness of the canning process. Among them are the existence of worms and mold, color of the product, size, ripeness, and presence of certain defects such as cuts, sunscald spots, and stems. Presence of worms, mold, and defects in the raw product contribute to much higher costs of processing. If quality is too low, particularly due to the worm and mold count, the product may not meet minimum quality standards of a particular brand or of the U. S. Food and Drug Administration. Color is crucial to the appearance of the final product, particularly in canned whole tomatoes.

It is evident that the profit of the canner is affected by the quality characteristics of the raw product. Therefore, he has an incentive to control the kind of product he will receive. Exerting control over certain production actions at the farm level is one way to accomplish this task. Time of picking affects color. Irrigation practices affect sizes and uniformity of size. The timing, quantity, and kinds of fertilizer affect color, size, maturity dates, and chemical composition of the raw product. Proper use of insecticides is also of great importance in obtaining satisfactory yields of a product with a desirable appearance.

Timing of deliveries

Since deliveries in each production area are highly concentrated, plants may easily become glutted. Therefore, processors desire to disperse acreage from which tomatoes are purchased, to lessen the concentration of deliveries.

Variety affects crop maturity and hence delivery. From an all-around processing standpoint, the Improved Pearson is the best variety presently available. But because Early Ace and Earliana Santa Clara varieties mature approximately a week earlier, canners may prefer that a portion of the acreage be planted to these in order to stagger the maturity schedule.

Some dispersion of maturity dates may be gained by using tomatoes grown both from seeds and from transplants. Transplants usually result in an earlier crop. Further spreading of crop maturity dates can be obtained through staggering the planting operations over a two- to three-week interval.

All these efforts, however, will be inadequate to accomplish complete coordination of grower and processor activities at time of harvest. A number of factors may cause the processing facilities to become temporarily glutted even though the planting decisions have been jointly controlled by canner and grower. Unusually favorable weather conditions may upset yield predictions. Unusually cool weather early in the season may slow up the early-producing areas so that they reach maturity about the same time as the ordinarily later ones. Unusually hot weather later in the season may hasten ripening in the late districts so that several areas will reach a peak at once. Use of large picking crews may enable one or a very few growers to deliver tonnage on a particular day which exceeds plant capacity.

The typical cannery does not possess sufficient flexibility to compensate fully for whatever actions or situations may occur at the producer level during harvest. If a processor is accepting delivery from a large number of growers, as is usually the case, coordination among these farm units is necessary to insure a uniform total flow from the fields. It is evident that attempts to control deliveries by the cannery are also of significance to the grower. Tomatoes may mature very rapidly and losses may result if cannery capacity is insufficient to handle them when they should be picked.

[20] Collins and Jamison, *op. cit.*

This discussion has shown many factors of mutual importance to canner and grower; their income positions are interrelated. This being the case, one would not expect that complete independence of action on the part of canners and growers would result in an optimum income solution for either or both parties. A need, therefore, exists for coordinated decision-making over the many production and processing activities that are important to the income positions of both growers and canners.

GROWER-PROCESSOR INTEGRATION

The role of forward buying

Practically all California canning tomatoes are contracted by canners prior to the time of planting. Forward or advance buying apparently has been used during most of the history of the California canning tomato industry. As early as 1922, when about 24,000 acres of canning tomatoes were harvested, an estimated 17,000 to 18,000 acres were under contracts to canners.[30]

This method of buying California canning tomatoes has been followed so consistently through the years that it may properly be termed an industry procurement policy. While forward buying is common also in some other agricultural crops, it has been given "little systematic attention by marketing economists."[31]

While buyers and sellers both favor a policy of forward buying for the many reasons previously discussed, a number of economic and institutional factors condition the actual time canners buy in a given year. Some of these factors tend to encourage late buying; others favor early buying. Certain characteristics of tomato production set limits on the time within which buying normally takes place. If canners want to induce growers to grow tomatoes or to affect certain decisions as to variety and location, they must buy at least long enough before planting time so that growers have adequate time to formulate production plans. The time required for this purpose varies among growers. Those growing tomatoes on their own land are most flexible in this respect. In northern California, they often can delay their decision until mid-April; they can, at this date, still buy tomato plants and get production under way in time. If they use field seeding, the decision must be made early enough to permit planting in late March or early April.

But most canning tomato growers in California do not own the acreage on which they plant tomatoes. They lease it from others, usually on a year-to-year basis. And because leasing occurs well before planting time, some growers must have assurances of an outlet well before this. These growers must receive contracts or promises of contracts much earlier than those growing on their own land.

Several factors condition the exact time canners prefer to begin buying. Some of the smaller canners make forward contracts for the sale of their processed products such as tomato paste. Often these canners do not begin buying all their requirements until this contract is signed. Thus, the ultimate buyer of the processed product indirectly influences the buying time of such canners.

More important, however, is the date when the leading canners begin their buying. Buying at a specified price seldom begins before one of the industry's

[30] Yaw, Fred L., *Report on Survey of the Canning Tomato Industry with Suggestions for Improvement* (Berkeley: 1924), p. 6. (California Agricultural Experiment Station Circ. 280.)

[31] Waugh, Frederick V., *Readings on Agricultural Marketing* (Ames: Iowa State College Press, 1954), p. 172.

recognized price leaders begins buying. Other canners simply are unwilling to make a price commitment until they know with some certainty what their competitors are paying. But after an industry leader has started buying and thereby effectively establishes a price, the remaining canners will soon begin. For even if a particular canner prefers to wait, competition among canners forces all to begin negotiations with growers.

While a processor may not wish to begin formal contracting until an industry leader does, he may be able to make a precontract arrangement to assure the retaining of good growers. Thus, in a real sense contracting may be said to begin well before formal buying begins. The larger canners are under greater pressure to begin contracting by the very size of the acreage they must contract. It may take longer than a month to sign up enough growers to fill their acreage requirement. The mere mechanics of allocating the acreage to the proper locations poses a large problem for the major canners.

Experience with forward buying

Approximately two-thirds of the canners interviewed in this study reported that they normally contract most of their expected requirements during January and February. When demand conditions appear to warrant a large tomato crop, contracting may begin before the first of the year. For example, the 1955 and 1956 crops were relatively large—116,300 and 151,500 acres, respectively. In both seasons contracting began in October and November, with most of the crop being contracted from December through February. On the other hand, when demand warrants smaller purchases by canners, they usually begin buying later. The 1953 and 1954 crops were relatively small—83,000 and 79,500 acres, respectively. In 1953 most contracting occurred from February through April and in 1954 during March and April.

All but two of the canners interviewed reported that they normally contact some of their growers before actual formal contracting begins. They often make tentative agreements with some growers during harvest for the next year's crop. Both growers and canners recognize that such tentative promises are not legally binding. Often such precontract arrangements simply involve informal exchanges of the following year's plans of each and result in a tentative promise by the canner that he will likely take a certain minimum amount of a grower's crop at going market prices. Some canners report that they have such informal agreements with all but their "fringe" growers. As one canner put it, "By contract time we already have most of our growers about half-way lined up." And some growers reported that, even though no promises of this sort are exchanged, they "know" that "their" canner will give them a contract when buying begins. Here the relationship between buyer and seller is of such long standing that neither bothers to contact the other before contract time.

Although nearly all California tomato growers prefer to grow tomatoes on a forward contract basis, some growers plant processing tomatoes without first receiving a contract for them. The industry refers to this practice as growing "open" acreage. These growers fall into three categories.

First and most important are those growers who intend to ship their tomatoes fresh as long as the price is better than the price for canning tomatoes. Then if fresh market prices are depressed, they plan on selling to processors. Most of these growers are located in the Merced area, on the southern edge of the northern California processing tomato region.

Second, some growers plant processing tomatoes without a contract because they are unable to get one at planting time. They hope either to obtain a contract before harvest or else to find out-

lets at harvest time with canners who have undercontracted.

Third, some growers intentionally grow tomatoes without a contract because they believe they will thereby earn a larger profit. They act on the assumption that at harvest time demand may be so great that canners will be willing to pay them higher prices for their crops than they offered at planting time. These growers generally plant only some of their land to open acreage. Some canners dislike contracting with such growers because they fear that the growers will try to deliver tomatoes from their open acreage along with those from contracted acreage if they cannot find other outlets for them. This can create serious difficulties for the canner during supply peaks.

No reliable data are available on the amount of open acreage grown for each of the above reasons. But the consensus of industry leaders is that since World War II less than 10 per cent of the tonnage each year has been grown on open acreage. This indicates that practically all California processing tomato growers, rather than growing for an open market, integrate their activities with particular canners by signing contracts before planting time. This forward contract is the legal basis underlying the integration of tomato growers and processors. Once a grower and processor sign such a contract, each can no longer act entirely independently of the other in certain important respects. These contracts spell out the duties and rights of each with respect to certain of their integrated activities.

Marketing contracts

Marketing contracts take on added significance when viewed as the legal basis of grower-processor integration. However, they are not necessarily the only rules spelling out this relationship nor does their legal wording actually indicate the manner in which this integration works in practice. In truth, the nonlegal agreements or understandings between growers and processors are often more important to successful integration than the legal ones. For, ultimately, it is the mutual satisfaction of growers and processors in their dealings with one another which determines the success of their integrated activities. Accordingly, we shall also consider some of the nonlegal bases of grower-processor integration.

We shall deal here mainly with the provisions of the standard tomato contract form issued by the Canners League of California. It is used by most of the tomato processors in northern California. Of the 29 canners interviewed, 21 used this form or some minor modification of it; only seven used their own forms, and two of these were similar to the Canners League contract in most respects. One small firm used the contract form recommended by the California Tomato Growers Association. Except where otherwise indicated, our references will be to the standard form.

Price provisions. Both parties usually consider price the most important contract item. The customary practice is for the parties to agree to a specific price per ton when the contract is signed.

Virtually all other contract items discussed below also affect the net revenue of farmers. Perhaps most directly related to price are the payment tolerances spelled out in the contract. Grades are not used in buying California tomatoes; nevertheless, quality has an effect upon the prices growers are paid. This adjustment is accomplished through payment tolerances. For example, in 1956, northern California canners, as a rule, did not permit any such tolerances on worms and mold. This meant that if 5 per cent of a load of tomatoes suffered from worm and mold damage the canner had to pay the grower only 95 per cent of the contract price. Most canners did provide for a payment tolerance of 5 per cent on general defects: if a grower delivered tomatoes with 5 per cent or less of general

defects, the canner paid the full contract price. But if 10 per cent of them had defects, the grower would receive only 95 per cent of the contract price.

Quantity provisions. The standard form contract specifies that growers deliver all tomatoes from a certain acreage. At times canners modify this provision by writing on the face of the contract that they need accept only a specified number of tons per acre. However, in recent years this practice of setting upper limits on deliveries apparently has not been very common.

In 1956 two canners using their own forms placed specific upper limits on the quantity of tomatoes they were obligated to accept. Both placed "estimated" tonnages on their contracts in addition to the acreage contracted. One of these processors employed a clause which stated that he need accept no tomatoes beyond this amount, and the other stipulated that he need not take more than 10 per cent in excess of the tonnage estimated.[32] In practice these firms have set the estimated tonnage figure, at least in part, on the past yield experience of their growers.

Delivery provisions. The quantity of tomatoes growers can actually market is modified by various delivery provisions: the times during which products may be delivered, the quality of deliverable products, and the rate at which they may be delivered.

One factor determining how much a grower may deliver to his canner is the period during which the canner will accept tomatoes. The standard form provides that canners need not take tomatoes before September 1 nor after October 31 nor on Saturdays, Sundays, and legal holidays. (For the ten areas shown in Fig. 6, 95.7 per cent of the crop was marketed in September and October.) One canner's contract sets the cutoff date at October 25 and another at October 26 or before this date (1) if his growers have already delivered an average of 20 tons, (2) if three-fourths of his growers have already delivered their entire crop, or (3) if his growers have made no deliveries during the previous seven days. The form recommended by the California Tomato Growers Association, which was used by one of the processors interviewed in 1956, does not include starting or closing dates.

Another important delivery requirement is that controlling quality. The standard form first defines "tomatoes suitable for canning." These specifications are taken verbatim from the tomato standards section of the California Agricultural Code. Next, the contract spells out the conditions under which canners may reject tomatoes. Clause (d) of this section at times has especially important implications for delivery. It provides that "any load of tomatoes offered for delivery hereunder may be rejected at buyer's option and turned back to seller if such load contains less than 60% by weight of 'well-colored' tomatoes, by which is meant that the average color of the tomato flesh is 90% good red tomato color as such color is shown on the California Standard Color Chart for Canning Tomatoes issued by the California State Department of Agriculture, Bureau of Fruit and Vegetable Standardization, in 1942."

Two canners using their own contracts have color requirements identical to those of the standard form. The other four canners' contracts inspected vary on this point. One provides that the canner may reject if less than 20 per cent are well-colored; another stipulates that the processor may reject if more than

[32] The Canners League Standard Form adopted November 19, 1935, also included such a provision. It stated in part: "Buyer agrees to take delivery hereunder of a tonnage of each variety named herein of not to exceed ten per cent (10%) in excess of the estimated tonnage of such variety. . . ." However, it gave the buyer the option of taking more than the estimated tonnage if he so desired. This provision had been deleted from the Canners League form by 1942.

20 per cent do not have a red color extending over 75 per cent of their surface; a third provides that the company will accept as much of the crop "as shall in its judgment" comply with the specifications of its contract; and the fourth, the California Tomato Growers Association contract form, agrees to take all loads having at least 5 per cent well-colored tomatoes, that is, all those meeting the state grade.

The potential significance of these provisions becomes apparent when it is recognized that canners customarily accept loads containing a much lower percentage of well-colored tomatoes than their contracts specify. For example, in the years 1952–1954, half (50.5 per cent) of the tomatoes that passed the state inspection were less than 60 per cent well-colored. While most processors could have rejected these tomatoes, very few did. Almost three of every four canners interviewed stated that they normally accept the state grade (at least 5 per cent well-colored) although the overwhelming majority of them specified 60 per cent well-colored in their contracts. A few canners admitted they were more strict in adhering to high color requirements at the peak of the season, when their plants tend to become glutted, than they were at other times. Thus, the large gap between contract terms and customary practice provides the processor with a means of controlling deliveries.

There are many other ways, too, in which a canner can control the flow of tomatoes to his plant. Perhaps the most important is an outright limitation on the amount growers may deliver during a specified time—the so-called quota or prorate. The standard form contains no such legal restriction, but nearly all processors add to their contracts a provision to this effect which gives them discretionary power to limit deliveries. This usually restricts the grower to delivery of not more than 2½ tons per acre per week or, equivalently, ½ ton per acre per day or 20 lug boxes (½ ton) per acre per day. Occasionally, there is some variation from this, such as 2 tons per acre per week or 16 lug boxes (800 pounds) per acre per day.

Two of the 29 processors interviewed gave no information on their use of the quota. Of the remaining 27, however, 24 included such a provision in their contracts, and 15 of them said they used this restriction to limit deliveries when they had problems of oversupply at the peak of the season. Only two canners stated that they never used the quota because they had sufficient capacity to match peak deliveries. The remaining seven processors prefer to use methods other than the prorate—for example, the supply of boxes may be reduced or their fieldmen may suggest to the grower that he slow down on picking for a few days. (It should be noted that when a cannery is operating at top capacity the supply of boxes may actually become short.) Even the three canners who have no prorate clause in their contracts do in practice use some kind of delivery limitation, such as slowing up on box supply or closing their plants on weekends, which the contract permits them to do. Most canners recognize that these limiting devices, although necessary for their own operation, may work a hardship on growers, and they make efforts to divert excess supplies to other processors whenever possible. Even when the quota is imposed, it normally remains only a short time—rarely longer than two weeks and often only a few days.

Tomato variety. All contracts specify the variety of tomatoes to be grown. They always call for either round or pear-shaped varieties. Some canners at times also specify a particular strain of round variety—for example, Improved Pearson or John Moran. As mentioned above, this is done more to control maturity date than product quality as such.

Planting time. California tomato

contracts no longer specify that canners shall determine planting time. The Canners League form gave canners this right as late as 1942. However, canners' fieldmen frequently advise or consult with growers in this respect. As mentioned above, processors attain staggered deliveries by relying mainly on geographic dispersion of acreage and prescribing the type of tomato to be grown rather than by controlling planting time.

Seeds and plants. The standard form provides that canners need not "accept any tomatoes produced from seed or plants other than buyer's seed or plants where in buyer's opinion the strain or variety may affect the quality or variety of such tomatoes." Although this would seem to indicate that canners require growers to use their seed, this is misleading. At one time canners did this, but today they do not. Many still handle seeds and plants for growers, but strictly as a service on a voluntary basis. Canners report that growers take adequate care in selecting their seeds and plants so that canners need not control this activity any longer.

Cultural practices. The standard contract form provides that "seller shall till, cultivate, fertilize, irrigate, and endeavor to eliminate and control worm and insect infestation by spraying or dusting with an insecticide, all in the manner customary or best adapted to the proper care and growth of the best quality of tomatoes." Canners report that today they need exercise practically no supervision of growers' cultural practices in these respects. In fact, most of them stated that California tomato growers generally know much more about proper cultural practices than their fieldmen. The main exceptions are new growers who sometimes receive considerable assistance from fieldmen. Also, at least one firm employs specialists who give its growers advice on disease and insect control measures. But this is strictly a service to growers: the canner is not legally required to give it nor are the growers obligated to accept it.

Time of payment. The standard form provides that growers be paid for each week's deliveries on the following Friday. All but one of the other forms provide for payment between Wednesday and Saturday of the week following deliveries. The one exception is a form providing for payment on the second Tuesday after delivery. Occasionally, despite the wording of the contract, a canner will pay a grower on some other basis at the grower's own request.

Lug boxes and pallets. California canners provide picking boxes and pallets to growers. Most processors charge a one-cent-per-box rental for lug boxes and payment for all damaged and lost boxes and pallets. Only five canners of the 29 interviewed provide lug boxes to their growers free of charge although two of these specify the one-cent-per-box rental in their contracts. With the exception of these few companies, most firms tend to follow the industry leaders on this matter. Thus, in 1956 most canners charged box rent; however, in times of short supply virtually all companies provide free boxes.

Hauling provisions. The standard form leaves it to the parties to decide which is to do the hauling from farm to plant. Some California canners provide hauling for growers, usually through contract haulers; others do not. In the latter case, canners give growers a hauling allowance which about equals the commercial hauling charge from the farm to the canner's nearest plant or receiving station.

Grading of tomatoes. The California Agricultural Code provides that all canning tomatoes must be inspected and graded by representatives of the California Department of Agriculture in order to determine conformance with the state's tomato standards requirements. The standard form provides that canners and growers may also inspect loads if

they are dissatisfied with the state grade. In practice the entire industry virtually always accepts the state grade as final, and we found almost complete confidence by growers and canners in the state grading system. All members of the industry agreed that third-party grading eliminated one of the most serious areas of potential friction between growers and processors.

Other contract provisions. The standard form covers several other matters which may affect the way grower and processor activities are integrated. Of occasional importance is a clause providing for arbitration of controversies over questions of fact involved in carrying out contract terms. Another provides for modification of the contract terms in the event of passage of legislation or marketing agreements affecting the industry. Also included is a provision which prevents the seller from delivering to the buyer any tomatoes grown on acreage not covered by the contract.

Processor integration through ownership

Thus far we have dealt only with nonownership forms of integration in this industry. At times, however, processors have integrated directly with their sources of supply through ownership. An appropriate question, therefore, is: what determines whether it is preferable to use ownership integration rather than some nonownership form?

In 1956 California canners themselves grew less than 3 per cent of their tomato acreage requirements. There apparently are several reasons why they have not found it desirable to grow significant amounts of their own supplies in recent years.

The optimum size farm for growing tomatoes evidently is considerably smaller than the optimum size processing concern. Management problems, to say nothing of the capital needs, associated with operating the acreages required for most modern canneries would be almost insurmountable. These problems are further magnified in firms processing a large number of different products, many of which require integration of processing and farm operations. As indicated before, California tomato canners process an average of 15.5 different products.

Inflexibilities as to location and quantity of tonnage also arise when canners operate their own farms. Acreage is commonly dispersed over a wide area in order to stagger delivery dates. Furthermore, many vegetable crops are grown within a well-developed rotation which includes nonprocessing crops such as alfalfa and grains. Such diversification of a processor's management interests would scarcely seem practical. Of course, these deterrents might not prevent integration through ownership if the offsetting advantages could not be obtained through other forms of integration.

Although processors may not grow all their own supplies, it may be to their advantage to grow some of them. Where farm suppliers do not grow the proper quality product and grower-processor integrating arrangements cannot be devised to bring improvement, processors are encouraged to grow some of their own supplies. However, this has not been a problem for California tomato processors. They report that tomato growers generally provide them with the kinds of products they want.

Another factor which might encourage processors at times to grow some of their own crops would be a fairly inelastic supply; in this event, they may cut procurement costs by growing some of their own needs. For example, a processor may wish to contract 5,000 acres of a given crop. But at going prices, he may be able to contract only 4,500 acres. He has three alternative ways of obtaining the additional acreage: engage in price competition, engage in nonprice compe-

tition for the marginal amount, or grow the additional 500 acres on his own or leased land. The first alternative would almost certainly increase the cost of his entire acreage, not just the additional 500 acres. The second might do the same although not necessarily so. But by the third method, he could obtain the extra 500 acres without raising the price paid for the other 4,500 acres. And, significantly, this processor would have an incentive to grow some of his own crop even though his farming costs were higher than growers'. For growing some of his own raw product would enable him to get his total requirements for less than if he bought *all* of his needs from growers.

If canners grow some of their own supplies for this reason, it is symptomatic of the absence of competition in buying. But competition has been keen among California tomato canners in recent years. Because most canners feel that their supply is quite elastic at the industry price, they normally would have no incentive to grow their own supplies. Of course, should the number of firms decrease materially and thereby make all firms more conscious of the impact of their own purchases on industry price, this situation could change.

PRICING POLICY IN PROCURING TOMATOES

Up to this point, we have dealt mainly with the motives and methods of grower-processor integration. Tomato farmers and processors alike have sound reasons for integrating certain activities. In many industries, forces such as those described above have led to vertical integration through ownership; that is, a single firm owns several stages of production. In such vertically integrated firms, there is no pricing in the common sense although, for accounting purposes, prices are often assigned to products produced at various stages of the integrated process. But in the case of grower-processor integration, pricing of the commodities exchanged must occur. Growers and processors may welcome integration of many of their production and marketing activities, but as long as ownership remains separate the returns going to the respective owners remain of crucial importance. The parties are not concerned simply with the potential aggregate income of the farm and processing operations but with the way this income is distributed between them. And unless a satisfactory exchange price (including nonprice items) is arrived at, such firms are unwilling to become integrated with one another. The following is an analysis of the functioning of the pricing process in this grower-processor integrated industry.

The policy of price leadership

The pricing policy in the California canning tomato industry largely reflects its market structure. In perfectly competitive markets, where no buyer or seller is large enough to affect prices by his own actions, no firm can be said to have a pricing policy. Each firm simply accepts market-determined prices and adjusts its operations to them. Conversely, in markets of relatively few buyers or sellers, firms must adopt a price policy of some sort since each firm cannot avoid having some effect on prices.

The market structure for California processing tomatoes is made up of many sellers and relatively few buyers. As was noted previously, four canners acquired about a third of the 1956 crop in northern California, eight acquired more than half, and 35 firms purchased virtually the entire crop. The extent of market concentration in particular geographic areas is even greater. (See Fig. 4.) On the other hand, these canners bought from about 1,500 growers, each of whom

acted in his own behalf in selling his crop.[33] Thus, we have an *oligopsonistic* market structure—few firms buying from many essentially unorganized sellers.

Firms in such industries must employ some type of pricing policy. The policy in the California tomato canning industry, as in many others with similar structures, is a form of price leadership—a price policy where one firm takes the initiative in making price changes for the entire industry.

Factors conducive to price leadership policy

A combination of factors makes the emergence of some form of price leadership on the buying side of the California tomato canning industry almost inevitable.

1. The structure of the industry—its relatively few buyers—makes perfectly competitive price behavior impossible. Only the very smallest firms can ignore the indirect consequences of their own buying behavior on prices. Economic theory and practice suggest that such industries are likely to develop some formal or informal price policy to prevent "price wars" or other disrupting forms of price competition.

2. The selling side of the canning tomato market is not *perfectly* competitive either. In order to maintain good relations, canners are forced to treat growers as individuals rather than as anonymous competitors. Processors almost unanimously reported that they do not dare pay prices lower than the general price established in the industry; to do so would result in serious deterioration of their relations with "their" growers. The experience of those who have done so has proven the wisdom of this feeling. For example, after the outbreak of the Korean War in June, 1950, the industry's price leaders increased the price originally agreed upon by $2.50 per ton. A few firms failed to follow this lead, as they legally could, because they had already closed their contracts at $20.00 per ton early in the year. But most of those failing to follow the price increase ran into serious grower resentment in subsequent years. Some growers, after six years, still felt strongly about the way they were treated by these firms. One firm apparently felt compelled to compensate for its 1950 behavior by offering growers special price and nonprice inducements in subsequent years.

Thus, if a firm feels that good grower relations can be maintained only if it will pay the competitive price, it must have knowledge of that price before it can sign up any large proportion of its growers. To avoid paying more than the competitive price, the firm will wait until some qualified buyer takes the initiative in deciding what that price should be.[34]

The growers themselves contribute to the practice of price leadership; they are hesitant about signing forward contracts with small and medium sized firms until a recognized leader comes out with a price. They have learned by experience that the larger firms may subsequently come up with a higher price which will be followed by the rest of the industry. Thus, both growers and small processors feel that they are likely to come out better in the long run if they regularly accept the price established by a recognized price leader.

3. The practice of forward buying also contributes to industry acceptance of a policy of price leadership. Forward buying complicates the price decision by

[33] The California Tomato Growers Association represents growers in many ways (see pp. 39–41). However, in the 1956 season, the Association was not a formal bargaining institution in the market. Its members did not have contracts permitting the Association to bargain for them.

[34] A means occasionally used to avoid choosing a price in the early stages of contracting is to sign "open price" contracts, i.e., those in which the canner agrees to pay the going price for the season. However, this practice itself indicates that those using it (growers and canners alike) will accept the price later established by the price leader.

forcing buying under conditions of great uncertainty concerning the future. Representatives of most small and medium sized firms indicate that because they do not have market analysts of their own, they prefer as a rule to leave the initial price decision to those firms most qualified to appraise market conditions.

The theory of price leadership

The term "price leadership" describes any pricing policy where one firm takes the initiative in making price changes for an industry. There are different types of price leadership and the resulting prices range from monopolistic to competitive levels.

"Dominant Firm" leadership. The best known cases of price leadership are those in which one firm, by virtue of its size, determines the industry's price policy.[35] The industry is assumed to consist of the one large firm and a great many smaller ones, none of which buys a large enough proportion of the total supply to affect the industry price by its own buying policy. Thus, the small firms are passive as to price—they simply adjust their operations to the industry price. In such a situation, the dominant firm is forced by circumstances to play the leader's role.

The theoretical model of the dominant firm type of industry structure turns out to be merely a modification of monopolistic structure; if the leader knows the prices his smaller rivals will offer, he can choose the price that maximizes his profits in much the same manner as a pure monopolist. The presence of the competitive fringe of rival buyers merely restrains the degree of the leader's monopoly power.

"Barometric" price leadership. The barometric price leader "commands adherence of rivals to his price only because, and to the extent that, his price reflects market conditions with tolerable promptness."[36] In other words, the leader acts as the industry's price barometer. and the others are willing to let him play that role as long as he performs it well. However, the firm that plays the role of price leader for an industry does not necessarily possess substantial market power.

The price set by the barometric price leader may be competitive, monopolistic, or something in between. Thus, it is possible to have a competitive or a monopolistic barometric price leader. Certain types of market structure are most conducive to competitive behavior, and certain patterns of action may be taken as implicit evidence of it.

First, if the leader has too many rivals to make some form of collusion or tacit understanding workable, the barometer may be forced to indicate a price at or near competitive levels. A more profitable price for the leader would be in constant danger of being shaded by one or more of his rivals who would see an opportunity for short-run gain by making price or nonprice concessions. Secondly, as Markham says: "Unless a particular firm has demonstrated unusual adeptness at adjusting prices to market forces, in the absence of conspiracy, one would certainly expect occasional changes in the identity of the competitive barometric price leader."[37] Finally, we might expect that when the competitive barometric price leader's choice does not accurately reflect supply and demand conditions, the price he establishes either

[35] Cf., Stigler, "The Kinky Oligopoly Demand Curve and Rigid Prices," *Journal of Political Economy*, vol. 55, no. 5, October, 1947, pp. 444–445; reprinted in The American Economic Association, *Readings in Price Theory* (Homewood, Illinois: Richmond D. Irwin, Inc., 1952), pp. 410–439. Also, Markham, Jesse W., "The Nature and Significance of Price Leadership," *American Economic Review*, vol. 41, no. 5, December, 1951, pp. 891–905.

[36] Stigler, "The Kinky Oligopoly Demand Curve . . .," p. 446.

[37] Markham, *op. cit.*, p. 897.

may not be followed or, if followed, may be modified considerably by a variety of nonprice concessions by other firms. The existence of more than a very few rivals, frequent changes of the price leaders, and frequent price or nonprice departures from the leader's announced price are inferential evidence that the barometric leader is of the competitive variety.

Both economic theory and actual industry experience suggest that price leadership in the California tomato canning industry is the competitive barometric type. For years, the industry's largest tomato processor was regarded by both growers and processors as the best qualified price leader and, in most seasons, set the price. In recent years, a second firm of comparable size emerged and has, on occasion, assumed the leadership role. While both of these firms are large, neither derives its position as price leader because of its size in the sense of the dominant firm theory of price leadership.

Furthermore, the identity of the leader has changed from time to time. When the established leader failed to play his part well (as judged by the rest of the industry), others temporarily assumed the role or the industry refused to follow closely. More recently, the firm which had been accepted as the price leader for the last few years announced early in November, 1956, that it would contract its 1957 crop needs at $20.00 per ton. A period of "wait and see" followed that announcement. A number of growers signed contracts at that price, but considerable grower resentment was expressed because this was a $2.50 per ton drop from the 1956 crop price. Apparently, few canners followed the leader's price. Then, in early December, another firm announced that it would buy its requirements at the old price of $22.50 per ton. In the following weeks, most of the other canners followed that price in contracting their requirements. This behavior suggests that the price leadership is of the competitive barometric type.

Another clue is the extent and forms of nonprice competition as discussed below. If the price leader approximated the dominant firm or the monopolistic barometric variety, we would expect (1) very little nonprice competition among buyers, and (2) if nonprice payments were offered growers, the price leader would take the lead in determining the number and size of such concessions just as he does in the case of price. But if price leadership is of the competitive barometric variety, we could expect the price followers to modify the leader's price substantially through nonprice competition. The evidence on this score further supports the hypothesis that the price leadership policy in this industry approximates more closely the competitive barometric model.

Although early in the season a price leader sets a price which usually is followed by the rest of the industry, the followers often resort to a wide variety of nonprice competitive devices in procuring their supplies. The following are most common:

1. Waiver of picking box rent. One of the most frequently used forms of nonprice competition is the waiver of picking box rent. Practically all contracts provide for a charge of one cent for each picking box used by the grower each time it is used. But, as one buyer put it, "Whenever a canner finds his supply a little short at the announced price, the first thing to go is the box rent." The elimination of box rent increases growers' net returns about 45 cents a ton. Also, at such times, canners may forego charges for lost or damaged boxes and pallets. Usually the contract requires the grower to "pay the reasonable replacement cost to buyer of all boxes and pallets lost, damaged, or destroyed." One canner spells out this amount at 80 cents per box and $3.00 per pallet not returned.

The same firms do not always take the initiative in eliminating box rentals in "tight" years. In some cases, the leaders themselves are the first to make this concession, but apparently, most often, the medium and small firms take the initiative. In any case, once several firms eliminate box rent, most of the others usually feel compelled to do likewise even if they have already signed contracts calling for such charges.

2. Hauling allowances. Another way in which canners frequently shade the price leader's announced price is to vary the amount of the hauling allowance given to growers. It is an industry practice to quote prices f.o.b. the farm and to quote the same price to all growers regardless of their location. Under this system, buyers absorb the hauling cost. Often, canners do the hauling themselves. But most frequently they give the grower a hauling allowance and leave it to him either to do the hauling himself or to hire others to haul for him. In the latter case, the hauling allowance is ordinarily the same as that charged by the contract hauler. But occasionally when canners have difficulties getting their supplies at the going price, the allowance may exceed that amount. This practice is rare in most producing areas except in "tight" years. But in certain deficit producing areas such as Oakland-San Jose, where canning capacity always is greater than tomato production, the hauling allowances paid by many canners often exceed actual hauling costs. This appears to occur because, while the price established by the price leader may accurately reflect overall supply and demand conditions, it does not represent conditions in that area. It should be recognized that while growers in deficit producing areas may receive more than other growers, net costs to canners buying from them may be lower than for tomatoes they can acquire from other areas.

3. Payment tolerances. Payment tolerances for worm or mold damage and for other defects vary. Particularly in years when supply becomes short at the price announced by the price leader, some canners readily increase payment tolerances in their contracts or fail to enforce them at harvest time. Small canners seem to follow this practice most frequently, though once it becomes fairly widespread in a given year, most others are forced to do likewise.

This practice may have the effect of increasing the net returns to some growers by a dollar or more per ton. For example, in 1954 more than 98 per cent of the state's canning tomatoes had some mold damage; 27.4 per cent had between zero and 1 per cent, 64.7 per cent had between 1 and 5 per cent damage, and 6.1 per cent had between 5 and 10 per cent damage. In the same year, 8.3 per cent of all round tomatoes inspected had 6 per cent or more general defects.

4. Credit. Some processors find it convenient to assist growers by providing them with preharvest credit—and occasionally with harvest credit—and taking repayment at harvest time. The extent of this practice varies with competitive conditions. Nearly all canners used credit extension to growers as an aid in procuring supplies during World War II. It was still practiced extensively in the early postwar years, but nearly all medium and large canners report that they have used it less since then. Some canners, especially those buying in the Oakland-San Jose area where competition for the available supply is always intense, have made use of this practice in recent years. A few small canners have apparently financed nearly all of their growers. Several representatives of firms indicated that they would like to get out of the "lending business" but, apparently, competition forced them to continue in it in order to keep especially good growers.

5. "Tie-in" arrangements. A particular kind of nonprice concession is given to some prospective tomato growers because of special competitive condi-

tions in other farm products. As few growers will raise tomatoes without a contract, the offer of a contract may itself be considered a nonprice concession in years when it is hard for some farmers to obtain them. Some growers are able to get tomato contracts in these years through a sort of tie-in selling arrangement. In these cases, the grower agrees to provide the canner with some other product if the canner will take the grower's tomato crop as well. The two crops most often tied in with tomatoes are peaches and asparagus. More than a third of the processors interviewed stated that they gave tomato contracts to peach or asparagus growers as an inducement to obtain the other crop.

This practice often adds to the processor's hauling costs. Of course, some of the growers so treated are located within the purchasing company's normal contracting areas, so the hauling distance for tomatoes is not inevitably increased. However, many peach growers who also grow tomatoes are located in the Marysville production area, and some companies would not expand their tomato purchasing so far northward were it not for the tied-in peach supply. Four canners specifically mentioned their Marysville peach-and-tomato growers in this light.

The practice of giving a tomato contract to a grower in order to obtain his peaches is the result of two factors: (1) canning tomatoes are considered a good cash crop by northern California growers, and thus a tomato contract can be used as an inducement; and (2) there usually is a tendency toward price competition among peach buyers which is frustrated by a clause in contracts they sign with the peach growers' bargaining association; the clause specifies that if a canner pays one member-grower a price higher than the price bargained for, he must pay all others the same price. Consequently, processors resort to this and other nonprice means of attracting peach growers. Although this practice is not a direct outgrowth of competitive conditions in the tomato industry, it is indicative of the nonprice considerations which at times are important in allocating resources of this and other agricultural industries. In principle, it is comparable to some of the forms of reciprocal favors exchanged between industrial concerns.[38]

6. Other services and concessions to growers. Quite apart from the periodic use of nonprice concessions mentioned above, some canners continuously offer special inducements to "their" growers.

Practically all canners will sell seeds and plants to growers who want them. Some firms offer technical assistance such as advice on crop rotation, disease control, irrigation, and fertilizer practices; such services, however, have become less important over time. One processing firm has entomologists who periodically inspect its growers' crops and advise them on pest control. Others have "field days" at which they keep growers posted on new seed varieties and cultural practices. A few distribute monthly newsletters and other publications of interest to the tomato growers. One canner carries on research to improve tomato varieties, and passes the findings on to his growers. This is done in part to control the quality of the raw product but also has the effect of helping his growers to attain superior yields.

Such continuing services or concessions differ in their basic causes from the periodic nonprice concessions. The periodic concessions are prompted mainly by a disequilibrium of current supply and demand at the leader's announced price; the continuing concessions are prompted by longer-run considerations. Firms granting them believe they will gain greater selectivity in integrating with

[38] Stocking, G. W., and Mueller, "Business Reciprocity and the Size of Firms," *The Journal of Business of the University of Chicago*, vol. XXX, no. 2, April, 1957, pp. 73–95.

good growers. So, in effect, such concessions represent a continuing, though difficult to quantify, premium over the price (including the periodic nonprice concessions) prevailing in a particular year.

This distinction between the reasons for the various nonprice concessions is important. The periodic types give us significant clues as to the price leadership policy followed in this industry; the continuing ones do not. Long-run price concessions by some or all firms are consistent with any of the price leadership models discussed above.

Pricing in the California canning tomato industry obviously cannot be like that found in some agricultural markets, e.g., the grain exchanges. There are not enough buyers to make complete independence of action possible. While perfectly competitive behavior is thus ruled out by the structural characteristics of the industry, the preceding analysis suggests that the industry's price leadership policy is of the competitive barometric type. Under these conditions we may expect results similar to those in competitive markets, even though they are not brought about in the same way and may seldom be identical to them in the short run.

Prices in this industry do seem to approximate what economists call effectively competitive levels. The price leader's role is limited mainly to that of acting as a barometer of competitive prices. The recent growth of a second large firm has intensified the buying rivalry that already existed in the industry. The existence of a quasi-bargaining association of growers has further tempered the market power of buyers. And the fact that few California tomato canners grow any of their own supplies suggests that the individual canner considers his supply relatively elastic. This further supports the hypothesis that price in this industry is effectively competitive.

IV. Some Concluding Observations on Grower-Processor Integration

DISTRIBUTION OF INCOME BETWEEN PROCESSORS AND GROWERS

California processing tomato growers and canners integrate some of their operations to achieve certain production and marketing economies. There are important physical input-output relationships between the raw and processed product, and the structure of the market creates market uncertainties for both growers and canners. Thus, there are important advantages in achieving a vertically integrated arrangement of some kind. But how does such integration affect the income positions of the integrating parties?

We concluded that the prices received by growers and paid by processors in this industry depended on the relative bargaining position of growers vis-a-vis canners. If our analysis of the pricing policies in this industry is correct, growers receive essentially competitive prices. The significant point to be emphasized here is that, if the market structure were different (for example, if growers were completely unorganized and if they sold to only a very few large canners), the income position of growers could be far different. It is the relative market power of the participants and not the mere existence of a vertically integrated relationship that is the crucial determinant of farmer and processor incomes. Thus, the

only way to determine how farmers fare under an integrated relationship is by careful analysis of the market structure within which it exists.

INCREASED INTEGRATION VS. DISINTEGRATION

Another implication of the present study is that there are forces working not only toward further integration but toward disintegration as well. For example, because today's California tomato growers are specialists in their business, they often know more about proper production techniques than processors' fieldmen. California canners control very few production practices of growers.

Further, processors no longer require growers to buy seeds or plants from them in order to control product quality. All processors have disintegrated from the plant business, as have most growers, and now several independent concerns grow practically all tomato plants and seeds for growers.

Also, as California growers have become financially stronger, credit institutions provide most of them with their credit needs. Practically all California tomato canners are doing less financing today than they did in the past.

Canner-grown acreage comprises virtually none of the total today, largely because growers are producing such satisfactory crops that canners have little incentive to grow any of their own.

It should be recognized that there is a variation in the *degree* of integration (that is, the number of grower decisions controlled) between California tomato growers and processors. Typically, canners' fieldmen give much more advice and assistance to new and less experienced growers. Similarly, processors are likely to exercise more rigid control over growers who are financially indebted to them than over others.

This evidence indicates that there are forces working toward less integration as well as toward a greater degree of integration between farmers and processors.

In attempting to ascertain the degree of integration existing in an industry, the observer must not confuse all services provided by canners as forms of integration. A distinction must be made between those services which are offered for purposes of economic integration and those which are simply nonprice payments to growers. For example, many canners originally supplied seeds to growers in order to control the quality of the raw product. But today canners supplying seeds do so as a service to growers. Thus, the reason for this act is no longer to integrate the activities of growers and processors in order to achieve better technical coordination, but rather it is part of the payment growers receive for their crops.

VERTICAL INTEGRATION AND PRODUCTION STABILITY

The argument has been made that vertical integration is a means for bringing about greater production stability in agriculture. It is true that vertical integration may facilitate better adjustment of supply to changes in demand than a nonintegrated marketing system depending entirely on price to perform this function. But unless considerable horizontal concentration in processing exists as well, serious instability may still arise because of the independent actions of processors. In part, it is such lack of concentration at the national level that causes frequent overcontracting and undercontracting of vegetable acreages with consequent wide variations in farm output. For example, between 1945 and 1956, California processing tomato acreage varied, on the average, more than 25

per cent from one year to the next. Thus, the degree of production stability found in a particular vertically integrated industry may, like income distribution, depend on the degree of horizontal integration as well.

It is not our purpose here to disparage the importance and significance of grower-processor integration. Previous sections of this study have detailed reasons for this type of interfirm relationship that are important to both grower and processor. Rather, the purpose of this concluding section is to recommend caution in accepting the conclusion that certain important goals associated with production stability and with producer and processor income positions may be obtained solely through increasing the extent of grower-processor integration. Nor is the conclusion warranted that irreversible economic forces are at work making for increased integration; there are also forces at work encouraging disintegration of certain grower-processor relationships.

ACKNOWLEDGMENTS

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APPENDIX A

CALCULATION OF AVERAGE FIELD-TO-PLANT DISTANCES

The information obtained from the large grower-sample and that supplied by the Farm Advisors in the 12 northern California counties made available all the data necessary for a description of the locational aspects of the industry; yet, a major problem was encountered in the analysis. Had the large sample been selected in accordance with standard statistical procedure, this difficulty would not have arisen. The sample would have been assumed to be representative of the universe of all growers, at least within certain limits. The large grower-sample could hardly be interpreted in this light in view of its limitations. However, there were at least two independent sources of data against which its acceptability or reliability could be checked. One was the statistics published by the California Crop and Livestock Reporting Service on the acreage grown in each county. With the information received from the Farm Advisors, these 12 counties were reclassified into 10 production areas (see page 33 and Appendix B), and the actual acreage included in each was estimated (table 17). Similarly, the sample data were organized on the basis of production areas, and the proportion of the true acreage in each area which was included in the sample was calculated. The variation in this proportion from one production area to another was very great, ranging from a low of 28.9 per cent to a high of 84.8 per cent. A similarly large variation was found when these proportions were calculated on the basis of counties rather than production areas.

A second check was provided by the number of acres purchased by each firm as reported in the interviews with processors.[39] The 29 firms included in the processor sample purchased almost nine-tenths of the acreage in the twelve-county area. A total of 11 other firms with 12 tomato processing plants were mentioned as destinations for grower acreage in the large grower-sample, and it was assumed that these 40 firms together accounted for all the acreage of canning tomatoes grown in the entire 12 counties (or 10 production areas). The 11 firms not included in the processor sample were all fairly small, and with some industry advice, it was not difficult to estimate the total acreage each purchased. Thus, control data were available for the acreage contracted by each firm, and a corresponding sample figure was obtained from the large grower-sample. Once again, the proportion of the true acreage included in the sample varied widely from firm to firm, ranging from 13.0 per cent to 73.6 per cent.

The distance from each sample grower's acreage to the plant of its destination was certainly a reliable figure. (For multiplant firms, enough information was obtained through processor interviews so that a reasonable allocation of the sample acreage could be made among individual plants.) However, any calculation of average distances either for groups of plants or for combinations of production areas would have to be weighted by acreage, and if the sample acreage were used without refinement, the results would be affected by the discrepancies described above. No simple weighting of sample distances by the true

[39] Throughout this report, reference is made to the purchase of acreage by processors. It should be noted that this does not imply outright purchase of land by canners but rather their contracting to buy tomatoes grown on that acreage. This terminology is widely used in the industry since tomato contracts are not usually written on a tonnage basis but in terms of acreage.

area or company totals would suffice to compensate for these variations because the relative importance of each company was not constant from one area to another. This was made clear in the processor interviews as a few firms supplied detailed data not only on their total purchases but also on their contracting patterns within specific areas. Nor was it possible to expand the sample acreage figures in an "across the board" fashion based, for example, on the proportion by which each sample area total fell short of its actual area total because this expansion usually violated the plant or company totals. Similarly, if the "correction factor" were applied on a plant or company basis, area totals would be upset. To illustrate this problem, a simplified numerical example is presented in Appendix Table 1.

If the sample acreage data shown in the table are expanded by rows to correct for plant discrepancies (for example, the factor for the first row, Plant A, is $25/16 = 1.5625$), a new problem results as shown in Appendix Table 2. Note in this table that although the totals for plants now agree with the actual plant totals, new discrepancies have arisen in the area totals. When the sample acreage data are expanded by columns to correct for area discrepancies (for example, the factor for the first column, Area 1, is $25/17 = 1.4705$), the opposite result occurs; area totals are in agreement, but plant totals are in error as shown in Appendix Table 3.

Since the actual acreage contracted by each plant within each area was unknown, what was needed was some method by which the sample acreages could be expanded to estimates of these unknown universe figures. This would have to be accomplished without violating either known plant totals or known area totals; that is, no discrepancies should remain in either row or column totals.

The method chosen was linear programming with certain minor modifications. For a few plants, there was definite knowledge that all their acreage was obtained from one production area; this was especially true for very small firms. Acreages destined for these plants were expanded to control totals inmmediately, and only the remaining plants—those for which there was a real choice of allocations—were included in the programming problem. The dimensions of the problem were thus reduced from 10 areas and 49 plants to 9 areas and 45 plants.

An infinite number of solutions can be found for linear programming problems; some criterion must be used to select the best one. In our particular problem, two solutions were obtained according to two alternative criteria. One was to assign the residual acreage in such a way as to minimize the over-all weighted distance from grower's field to plant; the other allocation maximized this distance. These solutions provided rough upper and lower limits on the variation in acreage patterns that might be present in the universe.

Consider as an example the simplified model previously presented for four areas and six plants. Here, the problem is to assign the residual acreage to individual cells in Appendix Table 4. Corresponding to that table is another one, Appendix Table 5, which shows the distance from each area to each plant.

If Appendix Table 4 is to have individual cell entries, Xij, where the i subscript refers to plants and the j subscript to areas, and Appendix Table 5 has entries, Aij, with subscripts similarly defined, the problem then is to specify the Xij such that:

$$(1) \qquad \frac{\sum_{i=1}^{6} \sum_{j=1}^{4} A_{ij} X_{ij}}{\sum_{i=1}^{6} \sum_{j=1}^{4} X_{ij}}$$

is a minimum and

$$(2) \qquad \frac{\sum_{i=1}^{6} \sum_{j=1}^{4} A_{ij} X_{ij}}{\sum_{i=1}^{6} \sum_{j=1}^{4} X_{ij}}$$

is a maximum,
subject, of course, to the constraints:

$$\sum_{j=1}^{4} X_{ij} = X_i$$

(the given total for the ith plant)

$$\sum_{i=1}^{6} X_{ij} = X_j$$

(the given total for the jth area)

$$X_{ij} \geqq 0$$

$$\sum_{i=1}^{6} X_i = \sum_{j=1}^{4} X_j .^{40}$$

In this hypothetical example, the residual acreage allocations turned out to be those shown in Appendix Table 6.

When the allocations shown in Appendix Table 6 are combined with the original sample data, we obtain as the two (maximum and minimum) estimates of universe values those shown in Appendix Table 7.

In this example, the over-all average weighted distance from grower's field to plant is 40.06 miles under the minimum acreage estimates and 47.85 using the maximum estimates. By comparison, in our actual problem, the minimum and maximum distances were 29.93 and 37.86 miles, respectively.

These alternate solutions, which provided rough upper and lower limits on the variation in acreage patterns that might be present in the universe, were not intended to represent the most extreme and unrealistic possibilities; rather, they were meant to be reasonable bounds on the probable variation. For this reason, the programming model was not permitted to assign residual acreage to all cells with complete freedom. Certain cells or extremely unlikely allocations were ruled out on the basis of information obtained from the processor sample. For example, Stockton firms do not purchase tomatoes in the San Jose area, and to have permitted them to do so in the program would have introduced unreal and unnecessary variation. This restriction was reflected in the hypothetical example just treated where, under the maximum allocation, Area 4 was arbitrarily excluded as a possible source of supply for Plants A, B, and C. This exclusion was not necessary under the minimum program because these particular cells represent such inefficient purchasing patterns that they are not used anyway.

All distances referred to in this report reflect the actual location of growers' acreage as observed in the large sample. Calculations of average distances, however, were weighted by acreage; and in all these instances, three estimates were made. One used the allocation of acreage as determined by the "minimum distance" program. Another used the acreage assignment given by the "maximum distance" program. A third distribution of acreage was selected as an intermediate estimate on a somewhat arbitrary basis. This would perhaps come closest to approximating the true situation in the industry, and it incorporates information from many sources—chief among them the processor interviews. This estimate is generally much closer to the minimum than to the maximum, which is what we should intuitively expect. In general, where only one distance figure is quoted in this report, it is this intermediate figure. When a range is shown in

[40] For an exposition of the particular method used, see Ford, L. R., Jr., and D. R. Fulkerson, *Solving the Transportation Problem* (The Rand Corporation: June, 1956), 15p. Processed. (Paper P-895.)

parentheses following this figure, the limits refer to the estimates derived from the minimum and maximum acreage programs. Any statements referring to differences between areas or groups of plants have been based not only on the intermediate but on the extreme calculations as well. That is to say, a difference was not considered significant unless it was apparent in all three sets of estimates.

TABLES FOR APPENDIX A

Appendix Table 1

Plants	Areas				Sample total	Actual total	Discrepancy: actual minus sample
	1	2	3	4			
	Sample acreage						
A	5	9	2	0	16	25	9
B	3	8	8	0	19	30	11
C	4	3	6	0	13	40	27
D	1	2	6	4	13	30	17
E	3	7	9	4	23	50	27
F	1	6	9	6	22	35	13
Sample total	17	35	40	14	106		
Actual total	25	80	65	40		210	
Discrepancy: actual minus sample	8	45	25	26			104

Appendix Table 2

Plants	Areas				Adjusted total	Actual total	Discrepancy: actual minus adjusted
	1	2	3	4			
	Adjusted acreage (plant basis)						
A	8	14	3	0	25	25	0
B	4	13	13	0	30	30	0
C	12	9	19	0	40	40	0
D	2	5	14	9	30	30	0
E	6	15	20	9	50	50	0
F	1	10	14	10	35	35	0
Adjusted total	33	66	83	28	210		
Actual total	25	80	65	40		210	
Discrepancy: actual minus adjusted	−8	14	−18	12			0

Appendix Table 3

Plants	Areas				Adjusted total	Actual total	Discrepancy: actual minus adjusted
	1	2	3	4			
	Adjusted acreage (area basis)						
A	7	21	3	0	31	25	−6
B	4	18	12	0	34	30	−4
C	6	7	10	0	23	40	17
D	2	4	10	11	27	30	3
E	4	16	15	11	46	50	4
F	2	14	15	18	49	35	−14
Adjusted total	25	80	65	40	210		
Actual total	25	80	65	40		210	
Discrepancy: actual minus adjusted	0	0	0	0			0

Appendix Table 4

Plants	Areas				Residual acreage to be assigned
	1	2	3	4	
A					9
B					11
C					27
D					17
E					27
F					13
Residual acreage to be assigned	8	45	25	26	104

Appendix Table 5

Plants	Areas			
	1	2	3	4
	Distance (miles)			
A	42	16	25	95
B	50	35	10	70
C	70	40	20	25
D	100	70	25	45
E	110	80	50	30
F	125	95	50	20

Appendix Table 6

Plants	Areas				Total	Areas				Total
	1	2	3	4		1	2	3	4	
	Allocation of acreage (minimum basis)					Allocation of acreage (maximum basis)				
A		9			9			9		9
B	8	3			11		11			11
C		27			27		11	16		27
D			17		17				17	17
E		6	8	13	27	3	15		9	27
F				13	13	5	8			13
Total	8	45	25	26	104	8	45	25	26	104

Appendix Table 7

Plants	Areas				Total	Areas				Total
	1	2	3	4		1	2	3	4	
	Acreage estimates (minimum)					Acreage estimates (maximum)				
A	5	18	2	0	25	5	9	11	0	25
B	11	11	8	0	30	3	19	8	0	30
C	4	30	6	0	40	4	14	22	0	40
D	1	2	23	4	30	1	2	6	21	30
E	3	13	17	17	50	6	22	9	13	50
F	1	6	9	19	35	6	14	9	6	35
Total	25	80	65	40	210	25	80	65	40	210

APPENDIX B

PRODUCTION AREAS

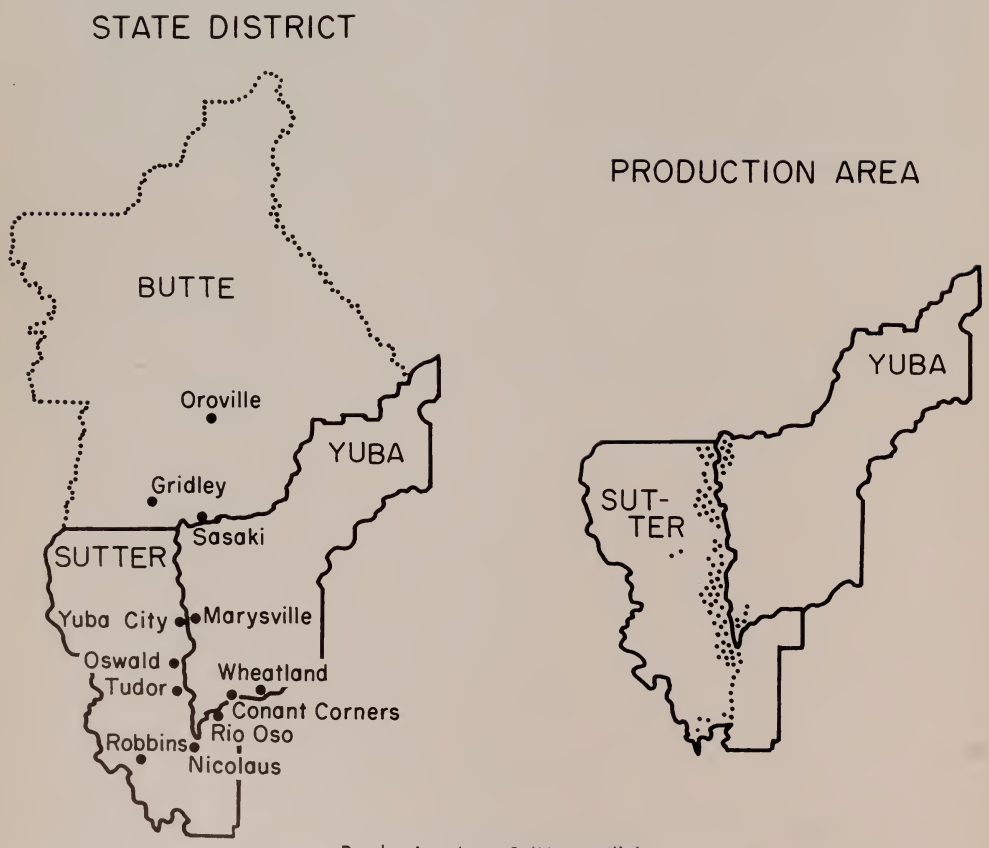
The major producing regions for canning tomatoes in northern California are shown in detail on the following maps. For each area, there is a pair of maps, one indicating the state inspection district and the other showing the corresponding production area (or combination of areas) as used in this study. The production areas were determined by the location of the large-sample growers' acreage.

Each state district is comprised of several inspection stations as indicated on the maps. The tomatoes inspected at each station are usually grown on nearby acreage. In some instances, the state district is larger than the corresponding production area because it includes inspection stations located in counties that were excluded from this study. These counties are indicated by a dotted line while the 12 counties included in the study are circumscribed by solid lines.

The production areas are shown in the form of dot maps, each dot representing 100 acres of canning tomatoes. The distribution of these dots (i.e., the location pattern of the acreage) is based on information from the large grower-sample and should be considered approximate. However, the number of dots (i.e., the actual acreage) is not a sample figure but an estimate of the true acreage in each area based on the 1956 county acreages published by the California Crop and Livestock Reporting Service (Table 17). There follows a brief description of each production area, a list of the inspection points for the corresponding state district, and their maps.

Production Area 1 (Marysville). This area is a strip of land ranging north-south along the Feather River about 30 miles in length and 7 miles in width. It extends from Live Oak on the north down to the "peach bowl" region of Marysville and Yuba City and on past Nicolaus to Verona. All the large-sample growers in Yuba and Sutter counties were included in this production area.

The corresponding state district includes inspection points at: Marysville, Conant Corners, Wheatland, Oroville, Sasaki, Yuba City, Oswald, Tudor, Gridley, Nicolaus, Robbins, and Rio Oso.

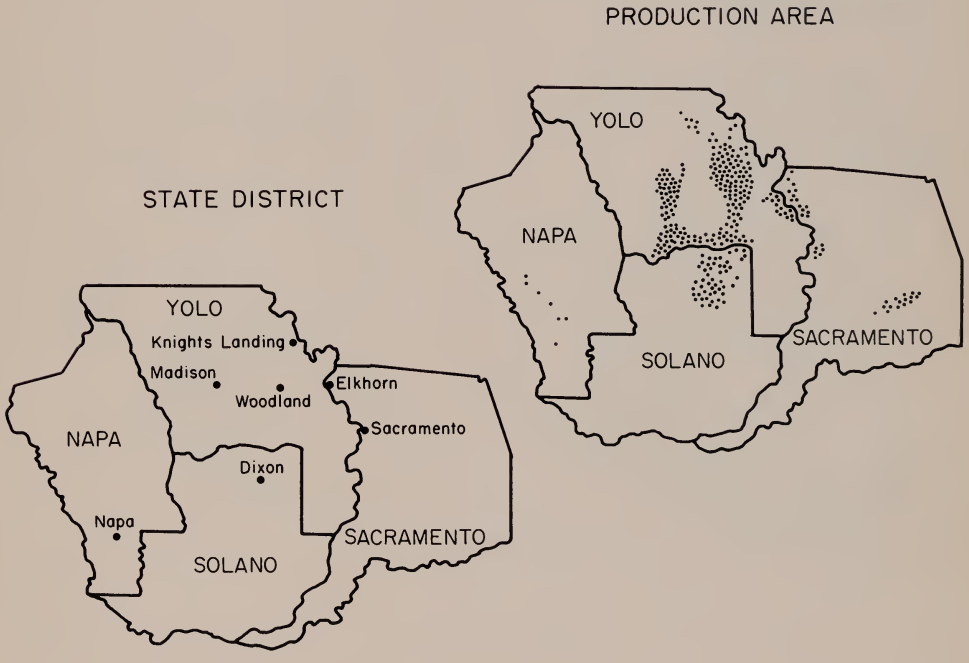


Production Area 1 (Marysville)

Production Area 2 (Napa). This area is a narrow strip of land about 4 miles wide and 15 miles long which extends along the Napa River in its northwest-southeast course between St. Helena and Napa. All the large-sample growers in Napa County were included in this production area.

Production Area 3. (Sacramento). This area includes all producing regions in Yolo County except for the one along the Sacramento River in the vicinity of Clarksburg; that is, it embraces the Woodland, Esparto, Winters, and Davis regions. It also includes the Dixon region of Solano County. In addition, it contains all producing regions in Sacramento County except for the Sacramento River area; that is, it includes the Elk Grove region along the Cosumnes River as well as the Natomas region just north of the city of Sacramento and a region called the "pocket" just south of the city. At its extremes, this large production area ranges 50 miles from east to west and 30 miles from north to south although the latter narrows considerably in and around Sacramento.

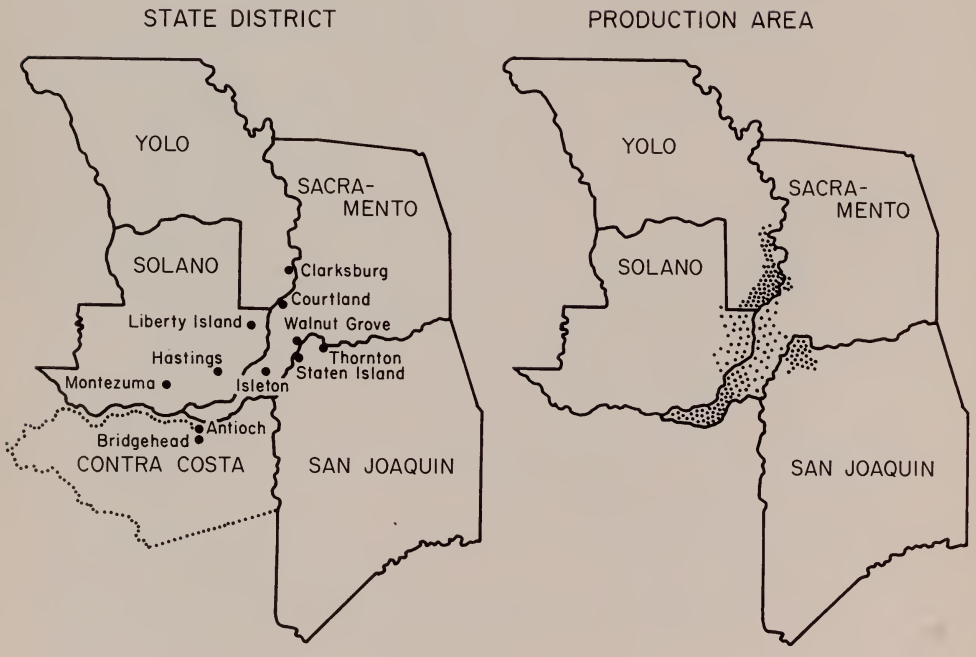
The state district corresponding to Production Areas 2 and 3 includes inspection points at: Sacramento, Elkhorn, Woodland, Madison, Knights Landing, Dixon, and Napa.



Production Areas 2 and 3 (Napa and Sacramento)

Production Area 4 (River). This is a crescent-shaped area about 20 miles wide and 35 miles long extending northeast to southwest along the Sacramento River. It includes the Sacramento River region of Sacramento County from Freeport southwest to Antioch. It also includes the Yolo County producing region along the Sacramento River in the vicinity of Clarksburg. In addition, it contains the Rio Vista (or Liberty Island) region of Solano County and the Thornton region of San Joaquin County.

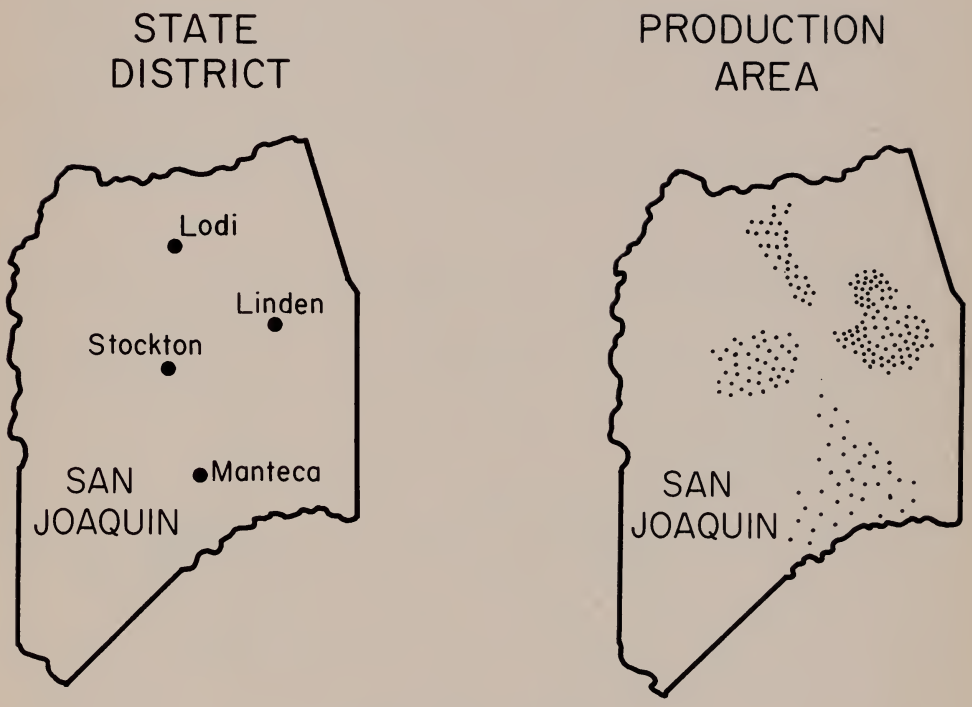
The corresponding state district includes inspection points at: Walnut Grove, Clarksburg, Courtland, Liberty Island, Hastings, Thornton, Staten Island, Montezuma, Antioch, Bridgehead, and Isleton.



Production Area 4 (River)

Production Area 5 (Stockton). This area, which extends about 30 miles from north to south and 25 miles east to west, contains all producing regions within San Joaquin County except those around Thornton and Tracy; that is, it includes the land around Lodi, Roberts Island, Stockton, Linden, Manteca, and Ripon.

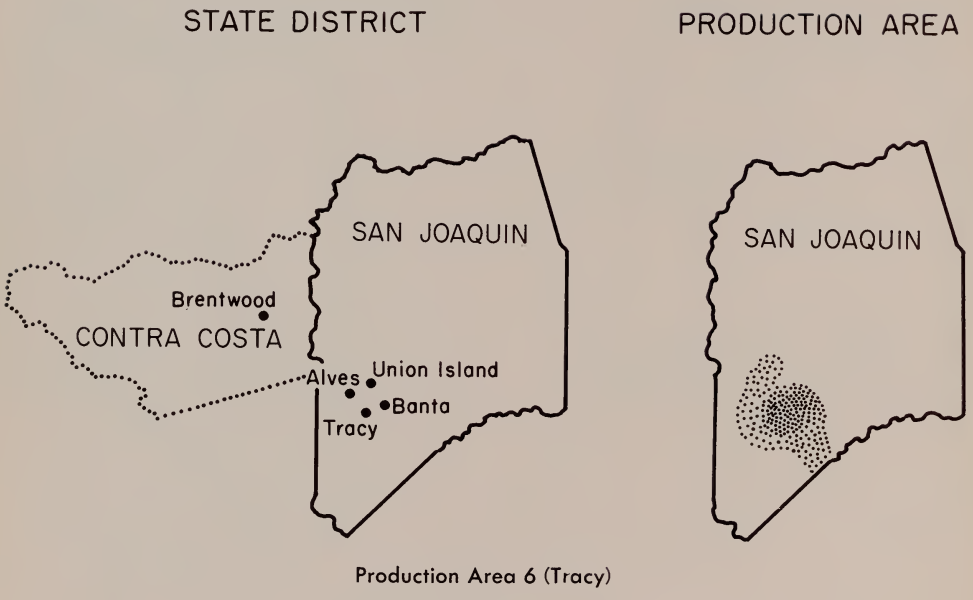
The corresponding state district includes inspection points at: Stockton, Linden, Manteca, and Lodi.



Production Area 5 (Stockton)

Production Area 6 (Tracy). This area includes the Tracy and Union Island producing regions of San Joaquin County. It extends for about 20 miles north-south and 15 miles east-west.

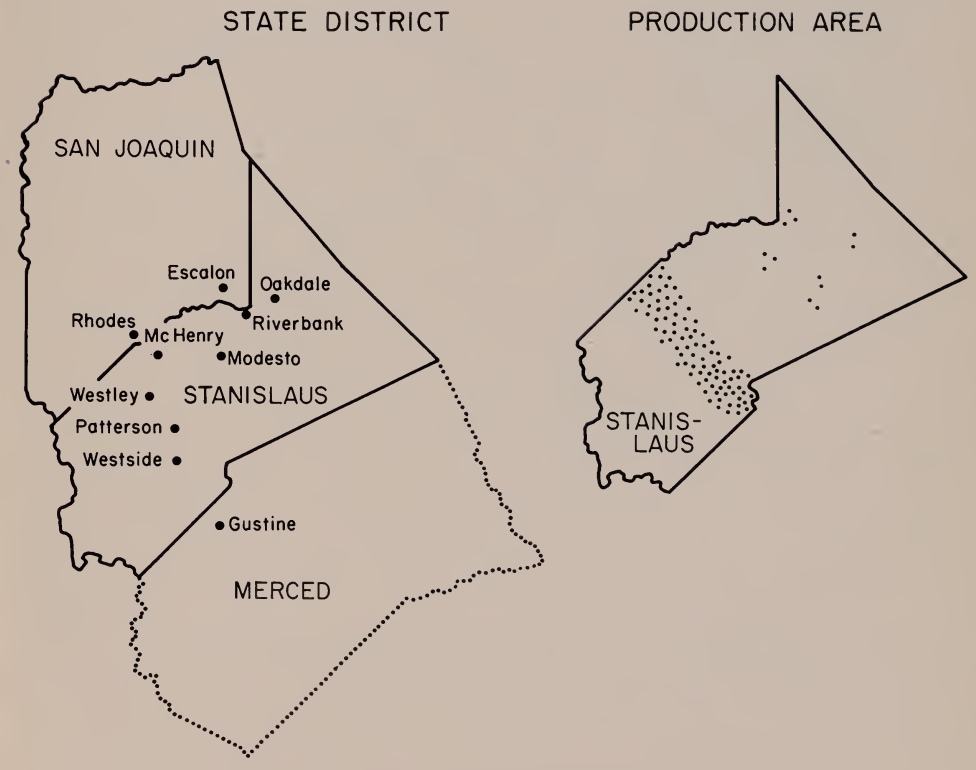
The corresponding state district includes inspection points at: Tracy, Union Island, Alves, Banta, and Brentwood.



Production Area 6 (Tracy)

Production Area 7 (Westside). All the large-sample growers in Stanislaus County were included in this production area. Most of them are located on a narrow strip of land about 7 miles wide which extends about 25 miles from northwest to southeast along Highway 33 (the Westside Highway) between Vernalis and Newman. It is bounded on the west by the Delta Mendota Canal and on the east by the San Joaquin River. There are also a few scattered growers in the eastern part of Stanislaus County who are included in this production area.

The corresponding state district includes inspections points at: Westside, Patterson, Rhodes, Westley, Gustine, Modesto, McHenry, Escalon, Oakdale, and Riverbank.



Production Area 7 (Westside)

Production Area 8 (Oakland-San Jose). This area is in the southern part of Alameda County and northern Santa Clara County. It extends about 25 miles north-south and 15 miles east-west. It includes all producing regions of Alameda County; that is, the area around Pleasanton, Centerville, Mt. Eden, and Warm Springs. It also includes the producing region around San Jose in northern Santa Clara County.

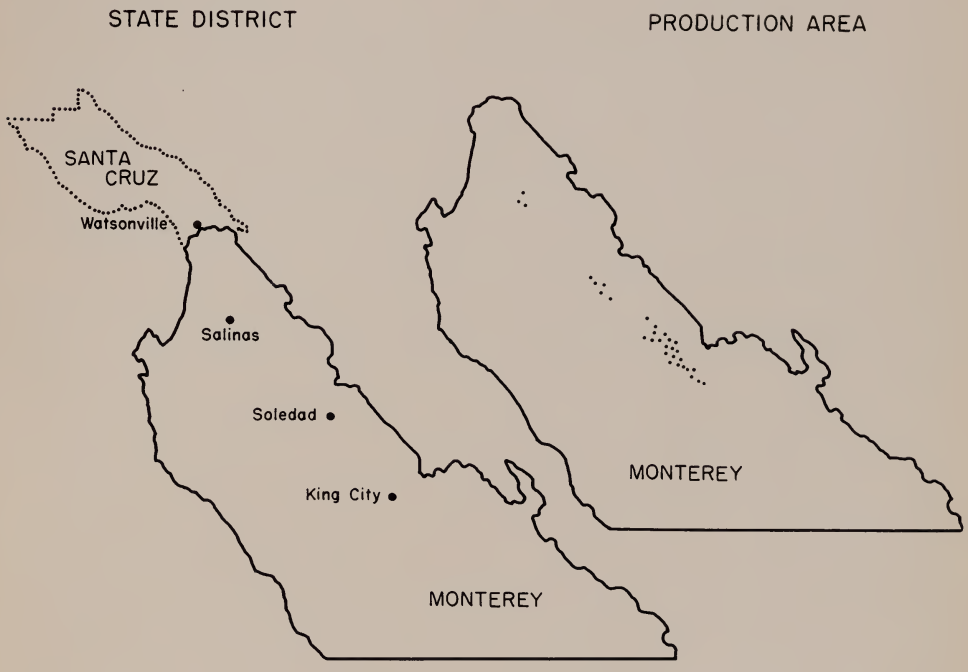
Production Area 9 (Gilroy-Hollister). This area includes the Gilroy producing region of Santa Clara County and all of San Benito County. There are three producing regions in San Benito, all in the northern part of the county in the vicinity of Hollister, namely, Paicines, San Juan Bautista, and the Bolsa. This production area extends 20 miles from north to south and 15 miles from east to west.

The state district corresponding to Production Areas 8 and 9 includes inspection points at: Oakland, Berkeley, Dublin, Centerville, Cupertino, Decoto, Fruitvale, Martinez, Hayward, Walnut Creek, San Jose, Sunnyvale, Santa Clara, Hollister, and Gilroy.

Production Areas 8 and 9 (Oakland–San Jose and Gilroy–Hollister)

Production Area 10 (Monterey). This production area is a narrow strip of land about 6 miles wide which extends about 45 miles from Salinas to below King City following the course of the Salinas River. All large-sample growers in Monterey County were included in this area.

The corresponding state district includes inspection points at: Salinas, King City, Soledad, and Watsonville.



Production Area 10 (Monterey)

CONTENTS

Consider ~~the~~ YOUR Future in Agricultural Economics

Agricultural economics applies SCIENCE to the BUSINESS OF FARMING . . . to the marketing of farm products, to the use of agricultural and range resources.

If agriculture is to continue as an important segment of our national economy, farmers must be adequately trained in the business of farming. The University of California's course of study in agricultural economics is a step toward that goal.

The curriculum . . . presented on the Davis campus, places major emphasis on Farm Management . . . but also provides instruction in Marketing, Co-operative Marketing, Agricultural Finance, Policy, and related subjects. Supplementary work may also be taken in such branches of agriculture as Agronomy, Animal Husbandry, Pomology, Agricultural Engineering, and the like.

The faculty . . . is comprised of trained, experienced economists, many with national and international reputations in their fields. The staff is active in service and research work in all of the Western States.

Job opportunities . . . can best be understood by pointing to positions now occupied by graduates. The largest percentage are farmers. Other lines of endeavor include:

Farm Managers • Credit work • Farmer Organizations
Marketing Organizations • Agricultural Extension work
State and Federal Departments of Agriculture work
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For more information: Write to the Department of Agricultural Economics, University of California, Davis.

or: See your University of California Farm Advisor for college entrance requirements.